PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

Edited and Issued Monthly by

THE INSTITUTION OF ELECTRICAL ENGINEERS

In Association with

THE PHYSICAL SOCIETY

THE AMERICAN PHYSICAL SOCIETY

THE AMERICAN
INSTITUTE OF ELECTRICAL ENGINEERS

ABSTRACTS 2371–2747

VOLUME 50 **SEPTEMBER 1947** NUMBER 597

PRINCIPAL CONTENTS

September 1947

		PAGE
51	**MATHEMATICS**	225
52	**ASTRONOMY. ASTRO-PHYSICS. GEODESY**	225
53	**PHYSICS**	227
530.1	**Fundamentals**	227
530.14	Theory of particles	227
530.145	Quantum theory	227
531	**General mechanics. Mechanics of solids**	228
531.7	**Mechanical measurements**	228
532	**Mechanics of liquids**	228
532.6	**Capillarity**	229
532.7	**Kinetic theory of liquids**	229
533	**Mechanics of gases**	229
533.7	**Kinetic theory of gases**	229
534	**Vibrations. Acoustics**	230
534.2	Propagation	230
534.232	Acoustic radiators	231
534.321.9	Ultrasonics	231
534.84	Architectural acoustics	232
535	**Optics. Radiation. Spectra**	232
535.33/.34	Spectra	233
535.34	Absorption	234
535.37	Luminescence	235
535.375.5	Raman effect	236
535.4	Interference. Diffraction	236
535.5	Double refraction	237
535.8	Optical instruments	237
536	**Heat**	238
536.2	Conduction. Transfer	238
536.48	Low temperature phenomena	239
536.7	**Thermodynamics**	239
537	**Electricity**	239
537.3	**Electric currents**	240
537.5	**Electric discharges and radiations**	240
537.531	X-rays	241
537.533	Cathode rays	241
537.534	Positive rays	241
537.591	**Cosmic rays**	242
538	**Magnetism**	243
538.3/.5	**Electromagnetism. Electrodynamics**	243
538.6	**Magnetic effects**	243
539	**Atomic and molecular structure**	243
539.152.1	Nucleus	244
539.155.2	Isotopes	244
539.16/.18	**Radioactivity. Nuclear disintegration. Nuclear particles**	245
539.17	Artificial disintegration	247
539.18	Neutrons	247
539.2	**Structure of solids**	248
539.3/.8	**Elasticity. Strength. Rheology**	249
541	**PHYSICAL CHEMISTRY**	250
541.11	**Thermo-chemistry**	250
541.121/.123	**Phase equilibrium**	250
541.124/.128	**Reaction kinetics**	250
541.18/.182	**Colloids. Disperse systems**	250
541.183	**Adsorption**	250
541.4/.6	**Chemical structure**	251
542.9	**Chemical processes**	251
543/545	**Chemical analysis**	251
548	**CRYSTALLOGRAPHY**	251
549	**Mineralogy**	253
55	**GEOPHYSICS**	253
551.5	**Meteorology**	254
57/59	**BIOLOGY**	255
61	**Medical science. Human physiology**	255
77	**PHOTOGRAPHY**	256

The headings printed in bold type will be found in the text. The others may be located by their U.D.C. number.

RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

Mechanical testing
Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

MATHEMATICS 51

: 530.145.6 = 4 *see Abstr.* 2415

912.2 : 621.317.39 : 518.5 *see Abstr.* 2374

947.44 : 534.21 = 5 2371

n Stokes' functions. BORDONI, P. G. *Comment. . Acad. Sci.*, **9** (*No.* 3) 87 (1945). *Ric. Sci. Ricostruz.*, 49–51 (*Aug.*, 1945) *In Italian.*—Stokes' treatment of elastic-wave equation leads to definition of a family unctions deemed more adequate for dealing with ation problems than Bessel functions. Recurrent ulae for the former are established, and numerical s have been prepared. J. A. W.

4 2372

tailored logarithmic scale. MERRILL, A. A. *Gen. . Rev.*, **50**, 45–7 (*May*, 1947).—Describes a method, provides nomograms, for the construction of rithmic graph paper with the appropriate (non-gral) number of cycles for spreading the data most nomically on paper of a given size.

.5 2373

cam for introducing periodic functions into mechanical es. YATES, K. P., AND SINCLAIR, G. *Rev. Sci. rum.*, **18**, 454–5 (*June*, 1947).

.5 : 517.912.2 : 621.317.39 2374

dynamical analogue. MINORSKY, N. *J. Franklin t.*, **243**, 131–49 (*Feb.*, 1947).—An electrical device is posed for the graphical integration of equations of type $\ddot{\theta} + p\dot{\theta} + q\theta = 0$, where p and q are functions θ or t. The device consists of a circular coil suspended a solenoid, the currents being controlled by photo-ctric means [see Abstr. 4315 (1931)]. The method is recommended for use in investigating the general qualitative aspect of integral curves. R. A. N.

518.5 : 621.317.39 2375

A potentiometric secular equation computer. FROST, A. A., AND TAMRES, M. *J. Chem. Phys.*, **15**, 383–90 (*June*, 1947).—An electrical computer for solving secular equations is described. The technique makes use of the linear equations from which the secular equation is derived. Each of the linear equations is successively represented by a potentiometric circuit. A series of successive approximations is carried out to arrive at the desired solutions. A.

519.21 = 4 2376

On an *a priori* probability law leading to the fiducial arguments of Fisher. DUMAS, M. *Rev. Sci., Paris*, **85**, 3–18 (*Jan.* 1, 1947) *In French.*—It is shown that, in normal theory, fiducial arguments can be expressed in terms of *a posteriori* probability if, and only if, an *a priori* joint distribution of the expectation α, and the precision h, proportional to $d\alpha dh/h$, be assumed. It is suggested that, in general, *a priori* distributions should be one of three definite kinds, the choice depending on the range of variation of the parameter. [H. Jeffreys' work is not fully taken into account.] N. L. J.

519.24 : 551.501.45 = 5 *see Abstr.* 2716

519.25 = 5 2377

On the standard error of counts with counting mechanisms. LOVERA, G. *Ric. Sci. Ricostruz.*, **17**, 223–8 (*Feb.–March*, 1947) *In Italian.*—Useful approximations to the formulae of Ruark and Devol [Abstr. 2122 (1936)] are obtained. Experimental verification of the formulae is described. N. L. J.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

1.042 2378

On the origin of the heavy elements. VAN ALBADA, G. B. *trophys. J.*, **105**, 393–405 (*May*, 1947).—Heavy elements may be formed in a degenerate electron gas of high nsity; a small correction in the formula for the packing nstant allows the formation of nuclei of atomic weights 240. Favourable conditions may occur in the interiors massive stars; on contracting to high densities, rotation ill begin to counterbalance gravity and the interiors ay cool and become degenerate, permitting the forma-on of heavy elements. The process results ultimately in explosion, which leaves the stellar remnants as white warfs. R. A. N.

23.531 : 621.396.96 2379

Evaporation of meteors. ECKERSLEY, T. L. *Nature, ond.*, **160**, 91 (*July* 19, 1947).—It is maintained that adar echoes [Abstr. 514 (1947)] are not produced by the ails of visible meteors, but by "scatter clouds" produced y the evaporation of small, invisible meteors.

23.7 2380

On the positive charge of the sun. KRAT, V. *C.R. Acad. Sci. URSS*, **55** (*No.* 3) 203–6 (1947).—To prevent an scape of excess electrons from the corona, the sun's lectric field must nearly wipe out the weight of coronal ons. An isolated prominence must similarly acquire an lectric field which may dissipate the ions in a few ours. T. G. C.

523.72 : 523.746 2381

Solar radiation at radio frequencies and its relation to unspots. MCCREADY, L. L., PAWSEY, J. L., AND PAYNE-SCOTT, R. *Proc. Roy. Soc. A*, **190**, 357–75 (*Aug.* 12, 1947).—Experimental studies of solar radiation on a frequency of 200 Mc/s are described. This radiation has characteristics similar to those of thermal radiation, but is always hundreds of times > the thermal radiation anticipated from the photosphere and sometimes greater by a factor of 10^4. The day-to-day intensity variations over a period of 6 months confirm a correlation with sunspots. The received intensity of radiation is subject to rapid fluctuations; sudden increases, or "bursts," of duration from a fraction of a second to a minute are characteristic. These rapid fluctuations are similar at widely-spaced receiving points, and it is concluded that most of them are extraterrestrial, and presumably solar, in origin. Directional observations, based on the interference phenomenon as the sun rises over the sea, indicate that the radiation originates not uniformly over the sun's disc but in restricted areas in the immediate vicinity of a sunspot group. Values of received intensity are at times too great to be accounted for in terms of thermal radiation, so that another mechanism producing radiation must exist. Radiation from gross electrical discharges is suggested. A.

523.72 : 523.854.1 : 621.396.812.5 2382

Radio-frequency investigations of astrophysical interest. REBER, G., AND GREENSTEIN, J. L. *Observatory*, **67**, 15–26 (*Feb.*, 1947).—Experimental work in the frequency range 9–9 400 Mc/s on the radio waves emitted by the Milky Way is reviewed, and the radiation tentatively ascribed to free-free transitions of electrons in ionized

interstellar H, though line emission may also be important. Temporary enhancements of solar type integrated over the Milky Way fail by a factor of 10^{14} to explain the observed intensities. Observations on radiation from the sun at radio wavelengths are also reviewed, with special reference to its intensity and polarization. Enormous enhancements during solar flares cannot be thermal in origin since they correspond to temperatures higher than the central temperature of the sun. Other possible origins are discussed. A full bibliography to Jan., 1947, is given. A. HU.

523.74 2383

On differential rotation and turbulence in the sun. TUOMINEN, J. *Observatory*, **66**, 340–3 (*Oct.*, 1946).—Solar differential rotation is considered as a large-scale current in the sun's outer part. The life-time of the eddies produced by the differential rotation is $\sim 2{\cdot}8 \times 10^6$ sec, and the kinematic eddy-viscosity is $\sim 10^{13}$ cm^2 sec^{-1}. These values give a mean free path of 5×10^9 cm and a mean velocity of 2×10^3 cm/sec for the eddies, quantities which fit well with the observed properties of sunspots but not with those of granulations. A. HU.

523.746 2384

On movements and origin of sunspots. TUOMINEN, J. *Observatory*, **66**, 387–91 (*Dec.*, 1946).—Cyclonic shear is supposed to form, at the solar surface, eddies elongated by the sun's rotation in the E.–W. direction. Secondary eddies shed at the ends of these are identified with sunspots, since their characteristic proper motions in longitude agree with observed spot movements. The observed magnetic polarities are not inconsistent with this view. A. HU.

523.746 : 523.72 *see Abstr.* 2381

523.77 2385

Solar absorption lines between 2 950 and 2 200 Å. DURAND, E., OBERLY, J. J., AND TOUSEY, R. *Phys. Rev.*, **71**, 827 (*June* 1, 1947).—Spectrograms taken on V-2 rocket flights are compared with the u.v. spectra of a number of elements, and many absorption lines are identified. This report is preliminary. W. E. D.

523.77 : 535.343 2386

The solar spectrum and the model of the solar atmosphere. STRÖMGREN, B. *Physica, s' Grav.*, **12**, 701–18 (*Dec.*, 1946).—An account of earlier work on solar and stellar atmospheres [Abstr. 1112, 1117 (1947)], on theoretical contours of absorption lines and on negative hydrogen absorption [see Abstr. 2387 (1947)]. T. G. C.

523.77 : 535.343 2387

The opacity of the atmosphere of the sun and the negative hydrogen ion. CHALONGE, D. *Physica, 's Grav.*, **12**, 721–32 (*Dec.*, 1946).—A brief account of work comparing the observed opacity of the sun's outer layers with that calculated for H^-. Agreement is good between 4 000 and 20 000 Å. T. G. C.

523.775.5 2388

Spectroscopic problems of the solar corona. WALDMEIER, M. *Physica, 's Grav.*, **12**, 733–8 (*Dec.*, 1946).—The problems discussed are: (*a*) local condensations in the corona; (*b*) coronal lines observed in the 1930 eclipse, but not later; (*c*) the heating of the corona. T. G. C.

523.78 : 537.568 : 551.510.535 *see Abstr.* 2719

523.78 : 551.593.7 = 5 *see Abstr.* 2730

523.823 2389

***M*-type stars and their parallaxes.** JACKSON, J. *Observatory*, **66**, 374–7 (*Dec.*, 1946).—An analysis of published *M*-star trigonometric parallaxes and a consideration of the selection of stars for observation leaves unsettled the question whether stars exist with luminosit intermediate between giants and dwarfs. Search suggested amongst stars brighter than 10^m with prop motions $\leq 0{\cdot}050''$. A. H

523.823 : 523.842 = 4 *see Abstr.* 2392

523.841 : 523.87 *see Abstr.* 2394

523.841.35.035.94 = 3 23

Period-luminosity relation in long-period variable sta MICZAIKA, G. *Z. Naturforsch.*, **1**, 421–5 (*Aug.*, 1946) *German.*—The relation in variables in the Cygnus clo is attributed to increasing TiO absorption in the la types. Infra-red measures confirm that when ba absorption is allowed for, no dependence of luminos on period remains. A. H

523.841.37 : 523.87 23

The line spectra of delta Cephei. PANNEKOEK, *Physica, 's Grav.*, **12**, 761–7 (*Dec.*, 1946).—A discussion general terms of results from twelve 3-prism spectra tak in 1929, in relation to modified forms of the pulsati theory. Deduced surface gravities are not in accordan with theory, and the atmosphere is not at any sta sufficiently extended to produce detectable effects diluted radiation. D. L.

523.842 : 523.823 = 4 23

The masses of the visual double stars and the empiric mass-luminosity relation. BAIZE, P. *Bull. Astr., Par* **13** (*No.* 2) 123–52 (1947) *In French.*—This paper makes comparison between the masses of 42 double sta calculated from the best available material, and as deriv from the theoretical mass-luminosity relation. T effect of the various errors is discussed and a formula derived, which is tested by applying it to the spectr scopic binaries and Trümpler's massive stars. E. G.

523.854.1 : 621.396.812.5 : 523.72 *see Abstr.* 2382

523.87 23

The effect of diluted stellar radiation upon the spect of astronomical objects. STRUVE, O. *Physica, 's Gra* **12**, 739–60 (*Dec.*, 1946).—A summary is given of t theory and of recent observations. D. L.

523.87 : 523.841 23

Atomic lines in the spectrum of R Andromedae. ME RILL, P. W. *Astrophys. J.*, **105**, 360–75 (*May*, 1947).- Verbal descriptions are given of the behaviour of atom lines in this Se variable during the period 10–103 da after max. Tables of displacements of absorption lin suggest, for neutral atoms (and Y II), an algebraic increase of shift with excitation potential, and t behaviour of bright lines also resembles that in M variables. Atoms of Y and Zr appear to be mo abundant than in Me stars. D. L.

523.87 : 523.841.37 *see Abstr.* 2391

523.877 23

The internal constitution of giant *M* stars. MENZE D. H. *Physica, 's Grav.*, **12**, 768–74 (*Dec.*, 1946).- A general survey of the problem leads to the suggestic that all giant stars are composed of a small hot Wol Rayet core, surrounded by an extended turbulent envelo of filamentary structure supported by radiation pressur convection and rotation rather than by hydrostat forces. The *gM* stars are regarded as slow nova developing into planetary nebulae. D. L.

523.877 23

On the radiative equilibrium of a stellar atmosphere. X CHANDRASEKHAR, S. *Astrophys. J.*, **105**, 424–34 (*Ma* 1947).—The results previously obtained [Abstr. 141 (1947)] for the equations of transfer of an atmosphe scattering radiation in accordance with Rayleigh's la

e extended to include the case of partial elliptic olarization. R. A. N.

23.877 2397

On the radiative equilibrium of a stellar atmosphere. XVI. HANDRASEKHAR, S., AND BREEN, F. H. *Astrophys. J.*, 05, 435–40 (*May*, 1947).—The various *H*-functions, hich have occurred in the solutions of transfer problems this series of papers, are tabulated from numerical lutions of the functional equations which they satisfy ee Abstr. 1419 (1947)]. Tables are also given for the act laws of darkening and degree of polarization of diation from an electron-scattering atmosphere. R. A. N.

23.877 2398

On the radiative equilibrium of a stellar atmosphere. VII. CHANDRASEKHAR, S. *Astrophys. J.*, **105**, 441–60 *May*, 1947).—A functional equation is established lating the laws of darkening and diffuse reflection for a mi-infinite plane-parallel atmosphere. Atmospheres of nite optical thickness are then considered. Equations re obtained for transmission and diffuse reflection cording to a general phase function. These equations are rewritten for a phase function expressible as a series of Legendre polynomials. Further equations determine the radiation field in the interior in terms of the scattering and transmission functions. R. A. N.

523.877 2399

On the radiative equilibrium of a stellar atmosphere. XVIII. CHANDRASEKHAR, S., AND BREEN, F. H. *Astrophys. J.*, **105**, 461–9 (*May*, 1947).—Tables are given of integrals and functions occurring in the theory of the continuous spectrum of stars [Abstr. 2027 (1946)]. R. A. N.

525.75 : 551.593 *see Abstr.* 2726

526.77 = 4 2400

Resonance and gravitational forces. LANGEVIN, P. *Ann. Phys., Paris* (*Sér.* 11) **17**, 265–71 (*June–July–Aug.*, 1942) *In French.*—An alternative method of using Boys' type of apparatus for determining the gravitational constant G is considered. If the external masses are rotated with an angular velocity equal to the natural period of torsional oscillations of the suspended beam, forced oscillation rapidly builds up to an amplitude $\gg$ the static deflection. Calculations of the motion and an estimate of the accuracy obtainable are given. B. C. B.

PHYSICS 53

FUNDAMENTALS 530.1

30.12 = 4 2401

Special relativity and the uncertainty theory. [Les hémas aléatoires devant la relativité restreinte.] DEDE-ANT, G. *Portugal. Phys.*, **2** (*No.* 2) 149–202 (1946) *In rench.*—The known particles are discussed as wave ackets whose phase is uncertain, with mean phase elocities which can be $<$ or $>$ light velocity. Lorentz ransformations for velocities $>$ light are given, which are omorphic with improper rotations. G. J. K.

30.12 : 531.51 2402

Non-linear invariants and the problem of motion. REGORY, C. *Phys. Rev.*, **72**, 72–5 (*July* 1, 1947).—he effect of adding quadratic invariants to the integrand f the usual variation principle in general relativity is onsidered in the light of a new approximation method. he case in which the quadratic invariant is a constant ultiple of the square of the scalar curvature is treated p to the Newtonian approximation, insofar as the roblem of motion is concerned. The Newtonian equa-ions result for sufficiently large "distances" between articles regardless of the order of magnitude of the ultiplying constant. The requirement that the "force unction" be finite everywhere places restrictions on the umber of "particles" p, comprising the system. When $= 1, 2$, the requirement is fulfilled. The less stringent equirement that the "force function" be finite when all "particles" coincide restricts p less severely. If the bsolute values of the "masses" are not all equal there s no restriction on p, but if they are all equal p is restricted o certain integral values. A.

530.12 : 531.51 : 537.1 = 3 2403

The relation between the variation principles of projective and four-dimensional relativity. LUDWIG, G. *Z. Naturforsch.*, **2a**, 3–5 (*Jan.*, 1947) *In German.*—It is shown that field equations obtained from variational principles in projective relativity, also follow from corresponding 4-dimensional variational principles. Generalized field equations, corresponding to those obtained by Jordan and Müller [Abstr. 2017 (1947)], are shown to follow from variation of an integral involving the scalar curvature of projective 5-space; these equations also follow directly from a 4-dimensional variational principle. R. A. N.

530.14 2404

Interaction between meson and nucleon. CRITCHFIELD, C. L. *Phys. Rev.*, **71**, 908–9 (*June* 15, 1947).—By attributing a magnetic moment to the "elementary nucleon" and introducing the appropriate vector potential in the Proca equations, a solution for the meson wave is obtained which remains finite with decreasing distance. W. E. D.

530.14 : 539.185.7 2405

Collision of neutrons with deuterons and the reality of exchange forces. WILLIAMS, J. H. *Phys. Rev.*, **71**, 908 (*June* 15, 1947).—The author points out that the experimental evidence invoked by Massey and Buckingham [Abstr. 1727 (1947)] is not as definitely in favour of an exchange force as these authors suggest. W. E. D.

530.145 2406

General properties of the characteristic matrix in the theory of elementary particles. II. MØLLER, C. *K. Danske. Vidensk. Selsk. Mat.-fys. Medd.*, **22** (*No.* 19) 46 *pp.* (1946).—[Part I, Abstr. 1735 (1947)]. For a given system the S-matrix is an analytic function of the energy W. The condition $S = 0$ determines W values for stationary states and other values which do not satisfy some auxiliary conditions. The condition $S = \infty$ describes an unstable system whose energy and decay constant are obtained from the corresponding complex value of W. G. J. K.

530.145 2407

Wave field with the spectrum of masses. BLOKHINZEV, D. *J. Phys., USSR*, **11** (*No.* 1) 72–6 (1947).—A discussion of linear field equations of high order and the corresponding commutation relations. Scalar fields are investigated in some detail; the formulation is then satisfactory only when the field is just the sum of simple scalar fields. G. J. K.

530.145 2408

Lower bounds for eigenvalues. DUFFIN, R. J. *Phys. Rev.*, **71**, 827–8 (*June* 1, 1947).—Barta's method [Abstr. 1500 (1937)] is extended to include Schrödinger's equation, and the boundary conditions relaxed; a simple rigorous proof of the method is given. W. E. D.

530.145 2409

A note on Weinstein's variational method. KOHN, W.

Phys. Rev., **71**, 902–4 (*June* 15, 1947).—Weinstein's modification of the Ritz principle is used to derive (1) a lower bound for the nth energy-level of a quantum mechanical system if a lower bound for the $(n+1)$th level is known; and (2) an upper bound for the nth level if an upper bound for the $(n-1)$th level is known. A.

530.145 = 4 2410

Some remarks on the significance of the theorem of composite probabilities in quantum mechanics. BASS, J. *C.R. Acad. Sci., Paris*, **222**, 1372–4 (*June* 12, 1946) *In French.*—If A and B are linear Hermitian transformations in a vector space, R, and a and b are random variables associated with A and B, the correlation between a and b is only defined when A and B commute. It is now shown that, without modifying a and b, the definition of the operators A and B may be extended so as to give a meaning to the correlation when A and B do not commute. L. S. G.

530.145 : 531.19 : 536.752 2411

Quantum mechanics and thermodynamic irreversibility. DAVYDOV, B. *J. Phys., USSR*, **11** (*No.* 1) 33–43 (1947).—Irreversibility is understandable in quantum, but not in classical statistical mechanics. An observable thermodynamic entropy S and an unobservable quantum entropy σ are defined. It is shown that $d\sigma/dt \geqslant 0$, and $S \geqslant \sigma$. G. J. K.

530.145 : 531.51 : 537.1 = 4 2412

Gravitation phenomena. Study of the interactions between matter and the particle of spin 2. TONNELAT, M. A. *Ann. Phys., Paris* (*Sér.* 11) **19**, 396–445 (*Oct.–Dec.*, 1944) *In French.*—The author's theory of a complex particle capable of existing in spin states 0, 1 and 2 [Abstr. 2476 (1946)] is used to describe a corpuscular mechanism capable of representing the interaction between charged particles and radiation, and also that between material particles and the gravitational field. The interactions are supposed to arise from the emission and absorption of the complex particles. Particles with unit spin generate an electromagnetic field, while those of max. spin 2 give rise to gravitational interactions. These modes of interaction are shown to be consistent with the macroscopic laws. R. A. N.

530.145 : 538.3 2413

The electromagnetic field in quantized space-time. SNYDER, H. S. *Phys. Rev.*, **72**, 68–71 (*July* 1, 1947).—Relativistically invariant equations of motion for the electromagnetic field are set up in quantized space-time. These equations are solved by a process similar to a Fourier analysis. A.

530.145.6 = 4 2414

On the wave-equations of particles of arbitrary [quelconque] spin. I–II. PETIAU, G. *J. Phys. Radium* (*Sér.* 8) **7**, 124–8 (*April*); 181–4 (*June*, 1946) *In French.*—In Part I a theory is suggested for particles of spin $nh/2\pi$ giving n or $n+\frac{1}{2}$ isobars of masses m, $4m$, . . . It reduces to that of Fierz when a symmetry condition is applied eliminating the higher mass states. In Part II the spin values $n = 3/2$ and $n = 2$ are discussed. G. J. K.

530.145.6 : 517.9 = 4 2415

The separation of variables in Schrödinger's equation. FORBAT, N. *Bull. Acad. Belge Cl. Sci.* (*Sér.* 5) **32** (*Nos.* 4–6) 258–65 (1946) *In French.*

530.145.63 2416

On the algebra of the meson matrices. HARISH-CHANDRA. *Proc. Camb. Phil. Soc.*, **43**, 415–21 (*June*, 1947).—It is shown that the algebra of the Duffin–Kemmer matrices can be handled quite neatly by introducing an extra dimension and by using the Γ-formalism of an earlier paper [Abstr. 210 (1947)]. By this means it is possible to derive identities similar to the De Broglie–Pauli identities for the Dirac matrices. To complete the analogy a Γ-formalism is also set up for the Dirac matrices. A

530.162 : 621.38 241

Statistical analysis of spontaneous electrical fluctuations. FÜRTH, R., AND MACDONALD, D. K. C. *Proc. Phys. Soc., Lond.*, **59**, 388–403 (*May*, 1947).—[Abstr. 2275 (1947)].

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.19 : 536.752 : 530.145 *see Abstr.* 2411

531.19 : 541.123 : 536.7 *see Abstr.* 2548

531.19 : 541.123.2 : 536.7 *see Abstr.* 2549

531.51 : 530.12 *see Abstr.* 2402

531.51 : 537.1 : 530.12 = 3 *see Abstr.* 2403

531.51 : 537.1 : 530.145 = 4 *see Abstr.* 2412

MECHANICAL MEASUREMENTS 531.7

531.714.2 : 535.247.4 = 4 *see Abstr.* 2468

531.717.1 : 534.321.9 *see Abstr.* 2450

531.764.5 : 621.317.39 241

German quartz clocks. *BIOS Rep.* (*No.* 1316) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 11 *pp.* (1947).—Abstr. 2223 B (1947)].

531.767 = 4 241

Measurement of the speed of projectiles. ROUSSELET, R. *C.R. Acad. Sci., Paris*, **222**, 1335–7 (*June* 3, 1946) *In French.*—Optical and photo-electric equipment is described. L. S. G.

MECHANICS OF LIQUIDS 532

532.122 : 537.531 : 535.36 = 4 242

Can the coefficient of compressibility of fluids be deduced from the X-ray diffraction pattern? YVON, J. *J. Phys. Radium* (*Sér.* 8) **7**, 201–2 (*July*, 1946) *In French.*—The intensity of scattering of X-rays by a monatomic liquid at vanishingly small angles should be $vkT\beta\times$ as great as that of the atoms scattering independently, where v is the number of atoms per unit volume, k the Boltzmann constant, T the absolute temp., and β the compressibility. Suitable data exist only for A; there is a discrepancy of a factor of ~5. A. J. C. W.

532.133 + 532.612.4 + 536.441 + 537.226.1 *see Abstr.* 2555

532.5 242

Some applications of the theory of flow in compressible water- and oil-bearing strata. SHCHELKACHEV, V. N. *C.R. Acad. Sci. URSS*, **52** (*No.* 5) 395–7 (1946).—Good agreement is found between experimental data and the author's previous theory of the flow [Abstr. 2043–(1947)]. L. S. G.

532.517 242

The velocity of fall of mercury drops in a viscous medium. BAGOTSKAYA, I. A., AND FRUMKIN, A. N. *C.R. Acad. Sci. URSS*, **55** (*No.* 2) 131–6 (1947).—A theory of Frumkin and Levich [*Acta Phys-chim.*, **20**, 769 (1945)] for the velocity of charged liquid metal drops is mainly verified for fall through ionic solutions saturated with hydrogen. G. J. K.

532.517.4 : 536.252 *see Abstr.* 2543

532.542 : 621.315.211.3 242

Pressure and oil flow in oil-filled cables at load variations. KNUDSEN, H. L. *J. Appl. Phys.*, **18**, 545–62 (*June*

47).—This paper presents a method for calculating essure and oil flow with due regard to both the hydraulic sistance of the oil canals and the elasticity of the sheath d the pressure armour, if any, and the compressibility the oil; it is restricted to cable sections terminated th oil reservoirs in which the pressure is constant. rmulae are given for pressure, oil current and amount oil which flows through a cross-section of the cable r an arbitrarily prescribed oil expansion per unit length. eneralized functions are plotted which make the calcula- n of pressure and oil flow, with simplifying assump- ns, elementary operations. Numerical examples are ven. A.

532.59 : 551.465 = 3 *see Abstr.* 2715

CAPILLARITY 532.6

532.612.4 + 536.441 + 532.133 : 537.226.1 *see Abstr.* 2555

532.612.4 : 536.655 2424

Note on the relation between the heat of evaporation and e surface tension of liquids. DE WIJS, J. C. *J. Phys. oll. Chem.*, **51**, 747–50 (*May*, 1947).—Two empirical lations, (*a*) and (*b*), between the heats of evaporation nd the surface tensions of liquids are derived from the rmulae: $L = k(T_k - T)^m$ (L = total heat of evapora- on at temp. T; T_k = critical temperature; k and m are nsts. dependent on the nature of the substances under vestigation; $m \simeq 0{\cdot}4$), and $\sigma = A(T_k - T)^n$ (A is a nst. like k and m; σ = surface tension; n should be the me for all sorts of liquids very near T_k). (*a*) is obtained elimination of temp., viz. $L = B\sigma^p$, if $B = k/A^p$ and $= m/n$; (*b*) is obtained by dividing the above formulae, ving $L/\sigma = C(T_k - T)^q$ where $C = k/A$ and $q = m - n$. rom included tables of data, agreement between calcu- ted and observed values for a large number of liquids very satisfactory. H. H. HO.

532.612.4 : 536.7 : 541.183.35 = 4 2425

On the extension of Gibbs' equation to the surface ten- on of surfaces not in equilibrium. The lateral chemical otentials of a surface phase not in equilibrium. Free nergy and surface tension of surfaces not in equilibrium. ynamic surface tension of a perfect surface. DEFAY, R., ND PRIGOGINE, I. *Bull. Acad. Belge Cl. Sci.* (*Sér.* 5) **32** *Nos.* 1–3) 36–51, 176–84; (*Nos.* 4–6) 335–50, 400–21 1946) *In French.*—The starting point in these studies has een to investigate the variables on which the thermo- ynamic functions of a surface phase not in equilibrium epend. It is shown that for such a phase these functions o not depend upon the surface phase alone, but also pon the conditions in the adjacent phases, and the roblem is to extend to systems not in equilibrium ermodynamics of capillary systems developed by ibbs. To do this the conception of another chemical otential (called "lateral") is introduced, and relations educed which enable quantitative calculations of these otentials and the surface tension to be made. The elations contain no arbitrary parameters but only niquely determined magnitudes, of which the physical nterpretation is very simple. The simple case of a perfect urface on a perfect solution has been studied and certain heoretical predictions made which, for lack of the ecessary data, it has not been possible to compare with xperimental results. F. E. H.

532.614 2426

Collisions of cloud droplets. SWINBANK, W. C. *Nature, ond.*, **159**, 849–50 (*June* 21, 1947).—Observations of rops (<2μ radius) of water and various oils in air howed that they never coalesced on collision. The hypothesis is advanced that the intermediate form during coalescence has a higher surface energy than that of the separate drops, and constitutes a barrier. The ratio of limiting kinetic energy under gravity to surface energy is very small for drops <50–100μ, and might be insufficient to overcome such a barrier.

KINETIC THEORY OF LIQUIDS 532.7

532.7 : 536.423 2427

Intermolecular forces and energies of vaporization of liquids. BENSON, S. W. *J. Chem. Phys.*, **15**, 367–73 (*June*, 1947).—By using a "smoothed potential" model for the liquid state and assuming isotropic, homogeneous expansion with temperature which involves no change in co-ordination, it is shown that it is possible to reduce the expression for the configurational energy of the liquid to a function of a single parameter, the molar density, D. For the distances occurring in liquids, an approximation is: $E_c = AD^{x/3}$. The energy of vaporization is given by: $E_v = A(D_l^{x/3} - D_g^{x/3})$. Values calculated from this last equation show excellent agreement with experimental values for a large number of both normal and "abnormal" liquids. Values of $x = 5$ or 6 both work, the latter being better up to the critical temperature. A.

532.7 : 548.73 = 3 *see Abstr.* 2694–5

532.72 2428

On the concentration dependence of the rates of sedimentation and diffusion of macromolecules in solution. Preliminary. SINGER, S. J. *J. Chem. Phys.*, **15**, 341–8 (*June*, 1947).—The concentration dependence of the osmotic pressure, rate of diffusion, and sedimentation velocity for solutions of high molecular weight solutes, on the basis of certain assumptions, have been shown to be interrelated. Experimental confirmation, however, has been lacking. Preliminary data are given which satisfy these inter-relationships, with fractions of cellulose acetate in acetone. If and when additional confirmation is produced, the assumptions involved in the hypothesis may be considered correct; these are: (1) that the frictional coefficient in diffusion is the same (excepting special cases of orientation during transport) as the frictional coefficient in sedimentation; and (2) that the driving force of diffusion is the gradient of the free energy of dilution of the system. A.

MECHANICS OF GASES 533

533.15 = 3 2429

The deposition of streaming Apiezon-oil mists by thermal diffusion. WEBER, R. *Z. Naturforsch.*, **2a**, 48–55 (*Jan.*, 1947) *In German.*—Experiments in which the mists are led through a Clusius–Dickel tube show deposition which, at low flow velocities, is in rough agreement with Einstein's formula of the movement of small particles in a temperature gradient. H. L.

533.15 : 539.155.2 *see Abstr.* 2620

533.275 : 541.183.56 *see Abstr.* 2677

533.5 2430

A cam operated vacuum valve. D'EUSTACHIO, D. *Rev. Sci. Instrum.*, **18**, 369–70 (*May*, 1947).

533.6.01 : 533.7 *see Abstr.* 2431

KINETIC THEORY OF GASES 533.7

533.7 : 533.6.01 2431

Cases of motion in a gas with non-colliding molecules. BURGERS, J. M. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 6)

573–83 (1947).—Expressions are obtained for the velocity distribution and properties of a gas of infinite mean free path, assumed initially at rest and disturbed by a moving plane or by two planes which compress it. G. J. K.

533.7 : 534.094 = 4 2432

On a possible method of studying the speed of energy exchange between the different degrees of freedom of gas molecules. GORÉLIK, G. *C.R. Acad. Sci. URSS*, **54** (*No.* 9) 779–80 (1946) *In French.*—If a gas is excited by a modulated sound wave of wavelength > the linear dimensions of the container, energy must be absorbed directly by internal degrees of freedom. Information could then be obtained from the variation with modulation frequency of the amplitude and phase of pressure changes. G. J. K.

VIBRATIONS . ACOUSTICS 534

534.094 : 533.7 = 4 *see Abstr.* 2432

534.131 = 4 2433

On the distribution of energy in acoustic spectra. HOSTINSKY, B. *C.R. Acad. Sci., Paris*, **222**, 1328–9 (*June* 3, 1946) *In French.*—Examples are given of formulae, $f(\nu)$, such that the number of frequencies of a given system between ν and $\nu + d\nu$ is $f(\nu)d\nu$. The vibrations of a solid elastic body may be resolved into the principal vibrations. If $e(\nu)$ is the energy associated with a principal vibration of frequency ν, and $E(\nu)$ the energy of the body corresponding to frequencies between ν and $\nu + d\nu$, then $dE(\nu)/d\nu = f(\nu)e(\nu)$. If the Maxwell–Boltzmann theorem applies, $e(\nu)$ is constant. L. S. G.

534.133 = 4 2434

Measurement of vibrations of a quartz prism using Pierce's acoustic interferometer. ÖZDOĞAN, I. *Rev. Fac. Sci. Univ. Istanbul* (*Sér. A*) **12** (*No.* 2) 53–79 (1947) *In French.*—The modes of vibration of a quartz prism 1×2×2 cm (1 cm along the electric axis) were studied; 38 modes having frequencies between 119·4 and 884 kc/s are recorded. H. J. H. S.

534.154 : 629.135 : 621.317.39 2435

A modern vibration measurement laboratory. COGMAN, A. J. *Electronic Engng*, **19**, 70–4, 76 (*March*); 109–13 (*April*); 152–6 (*May*, 1947).—The basic requirements for equipment to record mechanical vibrations are briefly reviewed. The characteristics and use of wire resistance strain gauges are then considered in some detail, with numerous illustrations from aircraft vibration work. H. J. H. S.

534.2 : 550.341 = 5 *see Abstr.* 2709

534.21 : 517.947.44 = 5 *see Abstr.* 2371

534.21 : 550.341 = 5 *see Abstr.* 2710

534.213 2436

The establishment of the dilatation effect in a field of sound waves. DAVIDSON, P. M. *Proc. Roy. Soc. A*, **190**, 418–22 (*Aug.* 12, 1947).—The dilatation effect in a field of sound waves (which may be described as a general dilatation of the matter in the more strongly vibrating regions relative to the matter in the regions of weaker vibration) is discussed in terms of a medium which, for mathematical reasons, is given a slight viscosity. In the theorems concerning this effect an established field is considered; but the process of establishment of the phenomenon is investigated in a special case. A.

534.213 2437

The propagation of an acoustic wave along a boundary. RUDNICK, I. *J. Acoust. Soc. Amer.*, **19**, 348–56 (*March*, 1947).—The sound field of a point source near the boundary of two media cannot be obtained by an acoustic-ray approach. In fact, such an approach, which utilizes the reflection coefficient for plane waves, leads to completely contradictory results at grazing incidence. A more rigorous solution is obtained, the procedure followed being exactly similar to that initiated by Sommerfeld to derive the electromagnetic field of a vertical dipole situated near a conducting plane. The solution shows that when the boundary medium has a high real specific acoustic impedance, non-zero fields are obtained at all points along the boundary. For bounding media adequately described by simple porosity theory, the acoustic pressure at the boundary $\propto 1/(\text{distance})^2$ and $1/(\text{frequency})^2$, at reasonably large distances and low frequencies. There appear to be decreased phase velocities along the boundary. Some calculations of the sound pressure as a function of height above a Quietone surface show, among other things, the presence of a minimum occurring some distance above the boundary. At large distances from the source there are very large decreases in amplitude as the receiver height is increased in the region above this minimum. A.

534.213.4 : 621.392 : 537.212 *see Abstr.* 2551

534.22 : 534.321.9 2438

Ultrasonic velocity in liquids at high frequencies. RAVINDRANATH, T. *Proc. Indian Acad. Sci. A*, **25**, 235–7 (*March*, 1947).—Ultrasonic velocities in H_2O and xylene were determined from 2–42 and 2–32 Mc/s respectively. No dispersion was observed. W. R. A.

534.22 : 534.321.9 2439

A peculiar ultrasonic effect on a binary mixture of liquids. ERNST, P. J. *J. Acoust. Soc. Amer.*, **19**, 272 (*March*, 1947).—Sound velocity measured by the striation method [Abstr. 1307 (1937)] in a mixture of 10–20% CCl_4 with 90–80% liquid paraffin (a mixture not obeying Raoult's law) > in either of the two pure components. The striations also break up into a honeycomb pattern, which remains for some hours. The phenomenon may be due to partial unmixing; it does not occur in chloroform-benzol mixtures, which obey Raoult's law. J. A. W.

534.22 : 534.321.9 = 5 2440

The velocity of ultrasonics in *cis* and *trans* dichloroethylene. BACCAREDDA, M., AND GIACOMINI, A. *Ric. Sci. Ricostruz.*, **15**, 161–2 (*Aug.*, 1945) *In Italian.*—A stationary-wave method (4 000 kc/s) was used, at const. temp (20°c). A table gives the values of velocity, and of density and adiabatic compressibility. The *cis* isomer shows the higher velocity. J. A. W.

534.222 2441

Propagation of sound through a liquid containing bubbles. CARSTENSEN, E. L., AND FOLDY, L. L. *J. Acoust. Soc. Amer.*, **19**, 481–501 (*May*, 1947).—Experimental data on the transmission, scattering, and reflection of sound by screens of bubbles are presented and shown to agree with theory. A parameter, related to the damping of acoustic energy by bubbles and which cannot be satisfactorily predicted from theory, is evaluated empirically from the data. A.

534.222.2 2442

On the reflection of a plane detonation wave. ZELDOVICH, J. B., AND STANIUKOVICH, K. P. *C.R. Acad. Sci. URSS*, **55** (*No.* 7) 587–90 (1947).—The mathematical theory of the reflection at an absolutely unyielding wall enables expressions to be derived for the explosion pressure, the velocity of sound in the products, and the impulse, on the standard theory of shock absorption. Assuming that $pv^3 = \text{const.}$ not only along the isentropic but also along the Hugoniot adiabatic line, expressions are derived for the same three physical "constants." J. S. G. T.

222.2 2443
ock wave in glass. BAIRD, K. M. *Nature, Lond.*, 24–5 (*July* 5, 1947).—High-speed photographs str. 1100 (1947)] were taken of a glass rod in which ock wave was generated at one end by a high voltage harge through a Cu wire fused in the glass. The far shattered in a time which fixed a lower limit for the e velocity at 18 500 ft/sec.

222.2 : 534.25 *see Abstr.* 2447

222.2 : 541.126 *see Abstr.* 2673

23 2444
ttenuation and scattering of high frequency sound es in metals and glasses. MASON, W. P., AND SKIMIN, H. J. *J. Acoust. Soc. Amer.*, **19**, 464–73 y, 1947).—By using pulses generated by crystals ed to the surface of the rod, attenuation and velocity surements have been made for Al and glass rods 2 to 15 Mc/s. The reflected pulses show evidence of ral normal modes. Longitudinal waves show delayed es of smaller magnitude that are caused by the gitudinal wave breaking up into reflected longi- nal and shear waves at the boundary. This effect is ll if the rod dia. $\geqslant 20\,\lambda$. The measured losses for ods show components $\propto$ freq. and $\propto$ (freq.)^4. The is the hysteresis loss found for most solid materials. second is caused by Rayleigh scattering losses which the result of differences in the elastic constants ween adjacent grains caused by changes in orientation. culated scattering losses agree quite well with the asured values. The fourth-power scattering law holds e well until the grain size is equal to $\lambda/3$. For higher quencies the scattering loss increases more nearly with q.)^2. Glasses and fused quartz have a loss directly portional to the frequency, showing that any irregu- ties must be of very small size. A.

232 2445
he thermophone as a source of sound in liquid helium liquid hydrogen. FAIRBANK, H. A., FAIRBANK, M., AND LANE, C. T. *J. Acoust. Soc. Amer.*, **19**, 7 (*May*, 1947).—The generation of sound by a ying heat source has been observed in liquid H and I, and a simple sound source useful for velocity and orption measurements in these liquids is described. A.

232 : 534.6 *see Abstr.* 2453

232 : 621.395.623.7 = 5 2446
pproximate methods for studying sound-sources. RDONI, P. G. *Acta Pont. Acad. Sci.*, **8** (*No.* 8) 61 44). *Ric. Sci. Ricostruz.*, **15**, 147–8 (*Aug.*, 1945) *In lian.*—The field radiated from a sphere is determined the case of velocity varying from point to point, in plitude and phase, and in the case of specified pressure, boundary conditions. On the basis of the results, re complicated boundary conditions can be dealt with approximate methods, such as screened loud-speakers. J. A. W.

25 : 534.222.2 2447
efraction of plane shock waves. TAUB, A. H. *Phys. v.*, **72**, 51–60 (*July* 1, 1947).—The direction and ength of the waves reflected and transmitted when a ock wave is incident on an interface between two es, are calculated, and the range of physically realizable aditions indicated. A.

26 2448
Sound diffraction by rigid spheres and circular cylinders. ENER, F. M. *J. Acoust. Soc. Amer.*, **19**, 444–51 (*May*, 47).—Measurements with a small probe microphone re made, and compared with theoretical calculations, the ratio to free-space pressure of sound pressure at the surface of a sphere (radius a) and a cylinder (dia. = length = $2a$) over the wavelength range $0{\cdot}1a$ to $3a$, and reasonable agreement obtained. In particular, the presence of a "bright spot" diametrically opposite the source was verified experimentally, but in the case of the cylinder its magnitude drops at a const. rate for $\lambda < 0{\cdot}2a$. Values computed for an infinite cylinder are tabulated in 10° steps for $0{\cdot}1a < \lambda < 2a$. A.

534.3 2449
Analyses of the tones of wooden and metal clarinets. PARKER, S. E. *J. Acoust. Soc. Amer.*, **19**, 415–19 (*May*, 1947).—The harmonic spectra of artificially blown clarinets were obtained on an analyser. The respiratory tract and the wood or metal of which certain instruments are made had no appreciable effect upon the steady-state spectra. Factors which have important effects include the pressure on the reed and the position at which pressure is exerted; the blowing pressure; and the position of the note in the register. Observation of a vibrating reed under stroboscopic light verifies the conclusion that it is a beating reed. A.

534.321.9 : 531.717.1 2450
Ultrasonic measurement of wall thickness in Diesel cylinder liners. STRUTHERS, F. W., AND TRENT, H. M. *J. Acoust. Soc. Amer.*, **19**, 368–71 (*March*, 1947).

534.321.9 : 534.22 *see Abstr.* 2438–9

534.321.9 : 534.22 = 5 *see Abstr.* 2440

534.321.9 : 534.845 2451
Absorption of ultra-acoustic waves in liquids. GUREVICH, S. B. *C.R. Acad. Sci. URSS*, **55** (*No.* 1) 17–20 (1947).—Introducing two coeffs. of viscosity, a modification of Stokes' law is derived which is claimed to provide a more adequate interpretation of experimental absorption data in most cases. G. F. H.

534.321.9 : 621.292 2452
The detection of internal leaks in aircraft hydraulic systems. NUCKOLLS, R. G., AND TRENT, H. M. *J. Acoust. Soc. Amer.*, **19**, 364–7 (*March*, 1947).—[Abstr. 2130 B (1947)].

534.6 : 534.232 2453
The Ordnance Research Laboratory underwater sound calibration station. EBAUGH, P. *J. Acoust. Soc. Amer.*, **19**, 478–80 (*May*, 1947).

534.6 : 621.3.012.8 = 5 2454
Electromechanical analogies and their applications to problems in electro-acoustics. NUOVO, M. *Alta Frequenza*, **11**, 157–75 (*March–April*); 214–44 (*May*, 1942) *In Italian.*—[Abstr. 2137 B (1947)].

534.612 2455
Measurement of transient hydraulic pressures. MONTGOMERY, L. H., AND WARD, J. W. *Rev. Sci. Instrum.*, **18**, 289–93 (*May*, 1947).—A cylindrical wire strain gauge was found superior to various others on the following points: (*a*) uniformity of response from ½ c/s to 10 kc/s; (*b*) continuous pressure/time output relationship; (*c*) sensitivity range (−200 to + several thousand lb/in^2); (*d*) static calibration. Details of construction and characteristics are given; the wire is wound round the surface of a long, thin-walled, closed cylinder. A.

534.64 2456
Some notes on the measurement of acoustic impedance. BERANEK, L. L. *J. Acoust. Soc. Amer.*, **19**, 420–7 (*May*, 1947).—A modified form of an earlier design [Abstr. 3012 (1940)] of impedance tube is described. It is capable of measuring the normal impedance of a sample by the variable length, variable frequency, or travelling microphone methods without disturbing the sample, and may be used to measure the transmission constant with the

aid of a long probe tube. Modern graphical aids to the calculation of the impedance from the quantities measured in the tube are described. Comparison of data obtained by the variable length and travelling microphone methods is made, and good agreement is found over most of the frequency range. It is shown that the clamping effects of the tube walls on the edge of a lightweight, non-rigid sample are serious enough to introduce large gyrations of the impedance curves at frequencies <500 c/s. A.

534.76 2457

A remarkable phenomenon with stereophonic sound reproduction. DE BOER, K. *Philips Tech. Rev.*, **9** (*No.* 1) 8–13 (1947).—To a practised listener the sound image heard with stereophonic reproduction generally appears to lie above (and at times below) a line between the loudspeakers, in other words it has elevation. This can be explained quantitatively by the hypothesis that the impression of elevation of sound above the horizontal plane of its source is derived from slight movements of the head. A.

534.833 2458

Acoustical materials and acoustical treatments for aircraft. NICHOLS, R. H., JR., SLEEPER, H. P., JR., WALLACE, R. L., JR., AND ERICSON, H. L. *J. Acoust. Soc. Amer.*, **19**, 428–43 (*May*, 1947).

534.845 2459

Some acoustic properties of marine fouling. FITZGERALD, J. W., DAVIS, M. E., AND HURDLE, B. G. *J. Acoust. Soc. Amer.*, **19**, 332–7 (*March*, 1947).

534.845 : 534.321.9 *see Abstr.* 2451

534.846 2460

Acoustical tests in the Scala Theater of Milan. PAOLINI, E. *J. Acoust. Soc. Amer.*, **19**, 346–7 (*March*, 1947).

534.851 2461

A distortion reducing stylus for disk reproduction. MCCLAIN, E. F., JR. *J. Acoust. Soc. Amer.*, **19**, 326–8 (*March*, 1947).—A stylus design is presented which combines the advantages of both large and small tip radii to secure satisfactory tracking on a wide variety of groove dimensions. A.

534.86 2462

Convex wood splays for broadcast and motion picture studios. RETTINGER, M. *J. Acoust. Soc. Amer.*, **19**, 343–5 (*March*, 1947).—Theoretical and experimental findings are presented. After a discussion of the term "diffusion," there follow some calculations intended to circumscribe the term mathematically. An experiment is described in which pillars were used for added diffusion in a sound-recording studio, and some criteria are cited for the use of such splays. A.

534.861.1 2463

A review of criteria for broadcast studio design. GURIN, H. M., AND NIXON, G. M. *J. Acoust. Soc. Amer.*, **19**, 404–11 (*May*, 1947).

534.862.1 2464

Recording studio acoustics. GREEN, L., JR., AND DUNBAR, J. Y. *J. Acoust. Soc. Amer.*, **19**, 412–14 (*May*, 1947).

OPTICS . RADIATION . SPECTRA 535

535.2 : 537.533.9 *see Abstr.* 2578

535.23.08 2465

Theoretical consideration in heat and infra-red detection, with particular reference to the pneumatic detector. GOLAY, M. J. E. *Rev. Sci. Instrum.*, **18**, 347–56 (*May*, 1947).—A brief mathematical review of the basic factors involved in infra-red detection, with emphasis on the concepts of equivalent circuits and efficiency. A fe theoretical aspects of the pneumatic detector are d cussed.

535.23.08 24

A pneumatic infra-red detector. GOLAY, M. J. *Rev. Sci. Instrum.*, **18**, 357–62 (*May*, 1947).—The devi described earlier [Abstr. 798 (1947)] has been modifi by the adoption of a Schlieren technique for registeri the movement of the collodion film. A Sb mirr deposited on the film alters, as it moves, the sharpne of focus of the image of a grid registered on a simil grid, and thus alters the light transmitted and pick up by a photocell. A typical cell had a time consta of 3 msec and equiv. noise input $\sim 0{\cdot}014$ erg sec^{-1} Greater speed can be obtained at the expense of sen tivity. The design of radiation-absorbing films discussed, and other infra-red detecting devices brie reviewed.

535.243 = 4 24

The correction for slit-width in spectrophotometr measurements. BIOT, A. *Ann. Soc. Sci., Brux.*, (*Sér.* 1) (*No.* 2) 127–36 (1947) *In French.*

535.247.4 : 531.714.2 = 4 24

Differential microphotometer. DANTEN, A. C. *Acad. Sci., Paris*, **224**, 1215–17 (*April* 21, 1947) *In Frenc* —Describes the design of a microphotometer for dete mining precise positions (not intensities) of lines X-ray spectrum plates. Light from a filament is co densed on the spectrum plate with a microscope objecti in the normal way, but the image formed by the examini objective is received by two close parallel slits, each wi a separate prism behind, deflecting the respective lig beams on to separate photocells. An amplifier a electric-eye facilitates finding the null setting of t plate, such that the two slits are receiving the san amount of energy, which occurs when the slits "straddl the max. It is claimed that a line 0·2 mm wide, density 0·5 > that of the background, can be set with a precision of 0·002–0·001 mm. A. C.

535.247.4 : 621.383 : 621.317.39 24

A logarithmic photo-multiplier tube photo-mete SWEET, M. H. *J. Opt. Soc. Amer.*, **37**, 432–3 (*Jun* 1947).—See Abstr. 805 (1947).

535.312 : 535.421 *see Abstr.* 2520

535.317 = 4 24

Contribution to the study of the third order aberratio of a centred system. SIMON, J. *Rev. Opt.* (*Théo Instrum.*) **26**, 121–45 (*May–June*, 1947) *In French.* A general study of the 3rd order aberrations in terms the geometrical properties of simple wave-surface Spherical aberration is associated with a paraboloid convenient parameter. With zero spherical aberratio it is shown that the departure from the sine-conditio determines an isoplanatic pupil position. If this pup also satisfies Finsterwalder's condition, the aberration the same for all points of the image. The method lea to a simple treatment of the Seidel aberration theory: it applied to the study of a number of particular cases.

H. H. HOP

535.317.1 = 4 24

On the illumination in the region of the image of a poi produced by a centred system suffering from spheric aberration. BIOT, A. *Ann. Soc. Sci., Brux.*, **61** (*Sér.* 1 (*No.* 1) 48–54 (1947) *In French.*—A simple photometri theory of the light distributions in point-images, th spherical aberration being considerable. The pupil i divided into concentric annuli of equal area. Light in an annulus is assumed to fall uniformly in the annulu

ercepted by the extreme rays on the chosen image ne. An example is given. H. H. HOP.

5.317.25.08 2472

Method for making precise resolution measurements. LEMAN, H. S., AND HARDING, S. W. *J. Opt. Soc. ner.*, **37**, 263–71 (*April*, 1947).—A "Kinetic Definition art" constitutes a device by means of which the gle subtended by a test-object can be varied while nserving its apparent distance. The contrast of the test-ject can be varied, as also can the brightness level of th this and the surround. It is arranged that the ective pupil of the observer's eye shall be $\geq$ 1 mm dia., d differences between observers are eliminated by using standard telescope for comparison. The method has en applied to a variety of optical systems. H. H. HOP.

5.317.25.08 2473

The production and calibration of Foucault test objects various contrasts. COLEMAN, H. S., AND CLARK, D. G. *Opt. Soc. Amer.*, **37**, 272–4 (*April*, 1947).—For testing e resolving power of optical instruments, high-contrast jects are used, consisting of alternate white and grey nds of equal width. Production of the objects entails e machining of grooves on a Zn plate, making ink npressions of the plate and photographing the im-essions. The objects are calibrated by means of a hoto-electric mechanism which records the reflectivity f the white and grey bands and indicates the number of hite bands per inch. Objects have been produced with nes up to 120/in and with contrasts of 1%.

35.317.3 2474

Chromatic correction of wide-aperture catadioptric ystems. WYNNE, C. G. *Nature, Lond.*, **160**, 91–2 *July* 19, 1947).—The chromatic variation of spherical berration in the two-meniscus system [Abstr. 2569 (944), 277 (1947)] is opposite in sign to the orthodox chmidt system. A combination of the two is suggested, which has been calculated to have $<\frac{1}{20}$ the colour error f either system.

35.317.6 2475

Light distribution in the optical image. HERZBERGER, M. *. Opt. Soc. Amer.*, **37**, 485–93 (*June*, 1947).—A method s proposed for obtaining information about the light distribution in an optical image. The characteristic unction of the optical system is approximated by a olynomial, containing terms up to the 5th or 7th order. he coefficients of this function having been found, large number ($\sim$ 100) of rays from an object point are hosen, so that they are evenly spaced in the aperture of he system. By means of the function, the intersection oints of the rays can be calculated in any desired image lane, to a close approximation. The intersection points vere plotted, representing each ray by a small dot. The igures show that these plots are very similar to photo-graphs of the image of a point light source. The image f a line element can be obtained by integration of a eries of such figures. A.

535.317.9 2476

Preparation of an evaporation technique of correcting elements for refracting optical systems. SCHULZ, L. G. *J. Opt. Soc. Amer.*, **37**, 509 (*June*, 1947).—The principle consists in forming a deposit of transparent dielectric on lenses so as to change the surfaces from spherical to aspherical. For the elimination of spherical aberration the thickness $= K[Y_0^4/4 - Y^2(Y_0^2 - Y^2)]$. ($Y_0$ = radius of lens, Y = distance from axis, K = function of focal length of lens, its shape, and the indices of refraction of the glass and the dielectric used). The deposit can be made directly on the lens or on a plane piece of glass which is then used in combination with the lens as a correcting plate. In addition to correcting completely a single lens, it was also possible to over- or under-correct it so as to eliminate the aberration of the optical unit of which this lens was a part. LiF and MgF are suitable dielectrics; practical details are outlined. A.

535.317.9 : 535.81 2477

A differential method for introducing non-spherical surfaces into calculation of optical systems. VOLOSOV, D. S. *J. Opt. Soc. Amer.*, **37**, 342–8 (*May*, 1947).—The form of a non-spherical surface is defined by expressing y^2 as a power series of x, a_k being the coefficient of x^k; y, x are Cartesian co-ordinates with origin at the vertex of the surface, the x-axis coinciding with the axis of the system. The effects of variation of the coefficients a_k on the aberrations are investigated, leading to a general method of treating the problem. H. H. HOP.

535.317.9 : 535.88 : 621.397.6 2478

Plastic optical systems for television. *Nature, Lond.*, **160**, 99–100 (*July* 19, 1947).—A short account is given of the processes in the manufacture of moulded transparent plastic Schmidt plates for the correction of spherical mirror projection systems.

535.317.9 : 621.397 : 535.8 *see Abstr.* 2533

535.323 : 549.514.51 : 535.561 *see Abstr.* 2529

535.327 : 548.0 2479

Thermo-optic behaviour of solids. I. Diamond. II. Fused quartz. III. Fluorspar. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A.*, **25**, 266–95 (*March*, 1947).—I. The thermal variation of refr. index μ for diamond from $-180°$ to 450° has been studied by a new method which determines $d\mu/dT$ directly as a function of T, using 4 358 and 5 461 Å from the Hg arc and Na 5 893 Å. A new theory to account for variation of μ with T has been advanced which expresses μ as the sum of two terms, one arising from the number of dispersion centres and the other from the polarizabilities of these centres. The latter term depends on the dispersion frequencies of the centres. $d\mu/dT$ has been related mathematically to variation of these two terms. This has been applied to the data on diamond and it is found that the rate of change of the dispersion frequencies with T is related to the rate of change of the fundamental lattice frequency of the crystal. II. The theory is applied to the thermo-optic properties of fused quartz and is found to account quantitatively for the experimental values of $d\mu/dT$ from 1 850–6 000 Å and $-130°$ to 500°. III. For fluorspar μ decreases with temp. The new theory is extended to cover this case and account has been taken of the partly electrovalent character of the bonding. W. R. A.

535.33 2480

Some remaining problems in the analysis of spectra. SHENSTONE, A. G. *Physica, 's Grav.*, **12**, 581–88 (*Dec.*, 1946).—These problems are mainly: (*a*) More complete analysis of complex spectra. (*b*) Observations of atomic spectra in the infra-red. (*c*) Theory of perturbed series. (*d*) Investigation of the effects of auto-ionization. L. P.

535.33 2481

Atomic spectra in solids and solutions. BROER, L. J. F. *Physica, 's Grav.*, **12**, 642–8 (*Dec.*, 1946).—The perturbations of an ion due to electrostatic forces caused by the surrounding atoms or molecules are discussed in view of applications to spectra of salts and solutions of the rare earths, which may be partly interpreted as perturbed atomic spectra. L. P.

535.33 : 537.531 *see Abstr.* 2569–70

535.33 : 537.531 = 4 *see Abstr.* 2571

535.33 : 538.615 : 539.156 2482

Electric depolarization of the Zeeman components. KLINKENBERG, P. F. A. *Physica, 's Grav.*, **12**, 627–38 (*Dec.*, 1946).—The depolarization of Zeeman components was observed in weak fields. This is caused by inter-ionic electric fields, whose influence can be better studied by this method than by the Stark effect. L. P.

535.33 : 538.615 : 539.156 2483

Theory of the electric depolarization of Zeeman components. BROER, L. J. F. *Physica, 's Grav.*, **12**, 639–41 (*Dec.*, 1946).—In order to explain the observed depolarization of the Zeeman components [see Abstr. 2482 (1947)] the second order perturbation theory is applied to find what mixing of wave functions with different values of the magnetic quantum number is caused by an electric field. An effect must exist, but there is no proof so far that it is the one observed experimentally. L. P.

535.33 : 551.510.3 2484

Spectroscopy of the higher atmosphere. VEGARD, L. *Physica, 's Grav.*, **12**, 606–14 (*Dec.*, 1946).—A list of lines and bands found in the auroral spectrum is given, with their probable interpretation. The relative intensity of these lines is variable: the importance of a correct physical interpretation of such variations is stressed. L. P.

535.33 : 551.594.5 = 3 *see Abstr.* 2733

535.33.03 2485

A chamber for operating arcs for spectrographic investigations in controlled atmospheres. MARKS, G. W., AND GARDNER, M. *Rev. Sci. Instrum.*, **18**, 370–1 (*May*, 1947).—The chamber is described. It is shown that the CN band spectra in the region 3 500 to 4 200 Å can be almost completely eliminated when C electrodes are burned in an atmosphere of He and O_2. A.

535.331 2486

Methods of analysis in the spectra of the rare earths and in the very complex spectra of thorium and uranium. SCHUURMANS, P. *Physica, 's Grav.*, **12**, 589–94 (*Dec.*, 1946).

535.331 2487

Note on the spectrum of Th III. LANG, R. J. *Phys. Rev.*, **71**, 907 (*June* 15, 1947).—A number of lines have been measured and identified between 2 000 Å and 350 Å. W. E. D.

535.331 : 538.615 2488

Hyperfine structure of Zeeman effect. JACKSON, D. A. *Physica, 's Grav.*, **12**, 568–80 (*Dec.*, 1946).—The Doppler width was reduced by perpendicular observation of an atomic beam illuminated by a hollow-cathode tube containing similar atoms. The hyperfine structure can be observed as narrow absorption lines superposed on the emission lines. An etalon provided the required very high resolving power (up to 20 millions). The hyperfine structure of the Zeeman effect was observed over a wide field range; a wide spectral range combined with high resolving power was here obtained with the use of two etalons in series. For the two *D*-lines, agreement with theoretical formulae is perfect. L. P.

535.336.2 : 537.56 *see Abstr.* 2584

535.337 : 536.55 2489

The determination of temperature from spectra. SMIT, J. A. *Physica, 's Grav.*, **12**, 683 (*Dec.*, 1946).—Temperatures of arcs can be derived from the rotational intensity distribution in the CN bands, using a prism spectrograph to measure the profiles of bands whose rotational structure is not resolved. Transition probabilities for atomic lines can be calculated by measuring their intensities in arcs whose temperature has been determined from the CN bands. A. G. G.

535.338 : 539.132 = 4 249

Concise review of the development of electronic spectroscopy of polyatomic molecules. DUCHESNE, J. *J. Phys. Radium* (*Sér.* 8) **7**, 97–104 (*April*, 1946) *In French.*

535.338 : 621.385.83 : 537.531 *see Abstr.* 2572

535.338.3 : 538.615 = 4 249

Forbidden lines in He I and their Zeeman effect. JACQUINOT, P. *Physica, 's Grav.*, **12**, 661–6 (*Dec.*, 1946) *In French.*—See Abstr. 1469 (1947).

535.338.332 = 5 249

Fine structure of the Hα. GIULOTTO, L. *Ric. Sci. Ricostruz.*, **17**, 209–16 (*Feb.–March*, 1947) *In Italian.*—The fine structure of the line has been investigated both with a Lummer–Gehrcke plate and a Fabry–Perot etalon. Besides some intensity anomalies, the separations of the various components appear to deviate slightly from the theoretical values calculated from Dirac's equation. L. P.

535.338.332 : 539.152.2 *see Abstr.* 2613–4

535.338.4 = 4 249

Spectrum of nitrogen in an atmosphere of xenon. HERMAN, R., AND HERMAN, L. *J. Phys. Radium* (*Sér.* 8) **7**, 203–8 (*July*, 1946) *In French.*—The spectrum of a discharge through a trace of N in excess of Xe has been examined from the infra-red to 2 000 Å. The Vegard-Kaplan bands of N_2 have an intensity of the same order as the Second Positive System, and 45 bands in the ultraviolet have been measured. The forbidden line of N at 3 466 Å is obtained. A new pseudo-continuous band with head at 4 923 Å may be due to a triatomic molecule formed by collision between two N atoms, in ^2S and ^2P states, with a normal Xe atom. A. G. G.

535.338.42 249

Erratum: The analysis of the vibration-rotation band ω_3 for $C^{12}O_2^{16}$ and $C^{13}O_2^{16}$. NIELSON, A. H., AND YAO, Y. T. *Phys. Rev.*, **71**, 825 (*June* 1, 1947).—[Abstr. 751 (1946)]. Corrections are given, necessitated by wrongly assuming the frequency of the rotational lines to be reduced to vacuum. W. E. D.

535.339.3 : 535.41 = 4 *see Abstr.* 2518

535.341 = 3 249

The total absorption in line spectra. MATOSSI, F. MAYER, R., AND RAUSCHER, E. *Naturwiss*, **33**, 219–20 (*Oct.* 15, 1946) *In German.*—The terms governing the total absorption of *n* spectral lines have been calculated for the superposition of *n* similar slit-widths but different spectral lines. W. R. A.

535.343 : 523.77 *see Abstr.* 2386–7

535.343 : 539.152.2 249

Spectroscopy at radio frequencies. BLEANEY, B. *Physica, 's Grav.*, **12**, 595–605 (*Dec.*, 1946).—A review of its applications to the study of magnetic moments of nuclei, and of molecular spectra. L. P.

535.343.2 = 4 249

The absorption of Canada balsam in the visible spectrum. BIOT, A. *Ann. Soc. Sci., Brux.*, **61** (*Sér.* 1) (*No.* 2) 136–7 (1947) *In French.*—The absorption spectrum of a 1-mm layer has been studied. There is a general absorption in all regions of the spectrum but an intense band in the violet. A table of optical density is given for λ600–400 mμ. The data have been applied to a consideration of the magnitude of the errors involved in using balsam in optical systems. W. R. A.

535.343.2 : 535.347 : 535.51–15 249

Absorption spectra with polarized infra-red radiation. MANN, J., AND THOMPSON, H. W. *Nature, Lond.*, **160** 17 (*July* 5, 1947).—Large Se mirrors have been used for the study of the spectra of many substances between 2 and 15 μ. Some crystalline solids (amides, dibenzyl, etc

re re-crystallized between rock-salt plates with a tain amount of orientation, and the variation of their ctra with direction of polarization gives information the nature of the bonds responsible for the different nds.

5.343.2 : 535.347 : 535.51–15 : 548.7 2499

Polarized infra-red radiation as an aid to crystal analysis. OOKS, D. A. *Nature, Lond.*, **160**, 17–18 (*July* 5, 47).—Observations on infra-red dichroism of organic stals using a Se mirror polarizer, are reported. The nsmission of an oriented-growth sample of succinic d at 2 900 cm^{-1} decreased from 75 to 1·5% as the arizer was rotated. The behaviour of the various nds of the substances gives information on the orienta- n of the responsible molecular groups. Results with enzoquinone and acetanilide are reported, which are agreement with X-ray measurements.

5.343.2 : 535.372–31 = 4 2500

Ultraviolet fluorescence and absorption spectra of solid mpounds of gadolinium. BERTON, A., AND BOULANGER, *C.R. Acad. Sci., Paris*, **224**, 1153–4 (*April* 21, 1947) *French.*—The u.v. absorption spectra of a number of mpounds of Gd have been studied. The band dis- cements resemble those of similar rare earth com- unds in the visible region of the spectrum. A narrow gion of u.v. fluorescence has been observed for some ts. W. R. A.

5.343.2 : 535.375.5 *see Abstr.* 2516

5.343.2–15 : 548.7 : 535.375.5 : 539.11 = 4 *see Abstr.* 2603

5.343.3 : 535.375.5 : 539.13 : 539.155.2 2501

Use of deuterium in the analysis of vibrational spectra. ALVERSON, F. *Rev. Mod. Phys.*, **19**, 87–131 (*April*, 47).—Review and bibliography (499 items) covering all uterated molecules whose spectra were reported prior June, 1946.

5.343.4 2502

Fine structure of the infra-red atmospheric oxygen nds. HERZBERG, L., AND HERZBERG, G. *Astrophys. J.*, 5, 353–9 (*May*, 1947).—The vibrational and rotational nstants of the $^1\Delta_g$ state of O_2 have been determined om new measurements of the 0,0 and 1,0 bands of the $^1\Delta_g - {}^3\Sigma_g^-$ transition at 1·2683 and 1·0674 μ. The results clude $\omega_e = 1\,509.3$, $x_e\omega_e = 12.9$, $B_e = 1·4264$, $\alpha_e = 0171$ cm^{-1}. R. F. B.

5.343.4 : 551.593.5 = 3 *see Abstr.* 2728

5.343.4–14 2503

Microwave spectra: methyl iodide. GORDY, W., SMITH, G., AND SIMMONS, J. W. *Phys. Rev.*, **71**, 917 (*June* 15, 47).—The $J = 1$ to $J = 2$ rotation-transition spectrum the region of 30 000 Mc/s has been examined, and dications are that the hyperfine structure is due to teraction of the quadrupole moment of the I nucleus th the molecular field. The C–I bond length is timated to be 2·13 Å. W. E. D.

5.343.4–15 = 4 2504

Study of infra-red spectra between 5 and 8 μ. I. Remarks the absorption, symmetry and modes of vibration of the olecule of benzene. II. Absorption spectra of mono- and -substituted derivatives of benzene. DEPAIGNE-DELAY, ., AND LECOMTE, J. *J. Phys. Radium* (*Sér.* 8) **7**, 33–42 eb., 1946) *In French.*

5.345.6 : 535.41 *see Abstr.* 2519

5.347 : 535.51–15 : 535.343.2 *see Abstr.* 2498

5.347 : 535.51–15 : 548.7 : 535.343.2 *see Abstr.* 2499

5.36 : 537.531 : 532.122 = 4 *see Abstr.* 2420

535.37 2505

An experimental study of concentrational quenching of fluorescence in solution. PEKERMAN, F. M. *C.R. Acad. Sci. URSS*, **52** (*No.* 5) 405–8 (1946).—The quenching was measured by photo-electric and by visual methods for 14 organic dyes, some other organic substances, and for some uranyl salts. An empirical exponential variation of the fluorescence with the concentration is confirmed. L. S. G.

535.37 : 535.51 2506

On the nature of elementary emitters and the polarization of photoluminescence. FEOFILOV, P. P. *C.R. Acad. Sci. URSS*, **55** (*No.* 5) 403–6 (1947).—Polarization diagrams of luminescent systems are constructed for the case when either the absorbing, or the emitting system, or both, are magnetic dipoles. An attempt is made to apply the results to establish the nature of the elementary emitters in uranyl compounds. L. P.

535.371 2507

Sm as a flash sensitizer in the alkaline earth phosphors. ANTONOV-ROMANOVSKY, V. V. *C.R. Acad. Sci. URSS*, **54** (*No.* 9) 775–8 (1946).—CaS or SrS with Ce or Eu give unaltered emission bands if Sm is added, but show diminished phosphorescence, and much increased flash under "red" light. These effects depend on the absorption of energy by Sm centres and its transfer over long distances in the crystal. The spectral sensitivity of the flash to light of different wavelengths (not restricted to the red but extending from ultra-violet to infra-red) is determined by the Sm and the base material. S. T. H.

535.371 2508

Light sum of flash and phosphorescence in CaS . SrS + Ce.Sm phosphors. MORGENSTERN, Z. L. *C.R. Acad. Sci. URSS*, **54** (*No.* 9) 783–5 (1946).—After excitation of CaS . SrS . CeSm by ultra-violet the light energy stored at room temperature may be released by infra-red or by heating. The thermal light sum is only about $\frac{1}{3}$ of the infra-red light sum, and even if much of the stored energy (up to $\frac{7}{8}$) is first released by infra-red, the same ratio holds between residual infra-red sum and thermal sum. S. T. H.

535.371 2509

Microsecond measurement of the phosphorescence of X-ray fluorescent screens. MARSHALL, F. *J. Appl. Phys.*, **18**, 512–18 (*June*, 1947).—Microsecond square-wave X-ray pulses were obtained by operating an X-ray tube directly from a radar pulser. The phosphorescent build-up and decay of light emitted by fluorescent materials was observed with a multiplier phototube connected to an oscilloscope. Oscillograms of $CaWO_4$ (radiographic intensifying screen) and $BaSO_4$ indicate simple exponential response, with decay to 1/*e*th intensity in 6 and 0·8 μsec, respectively. $MgWO_4$ and Patterson B (fluoroscopic) and D (photofluorographic) screens were found to complete their main response to μsec excitation in 10 to 100 μsec, but their decay is not exponential. A.

535.371 : 621.386.832 2510

Physical properties of calcium tungstate X-ray screens. COLTMAN, J. W., EBBIGHAUSEN, E. G., AND ALTAR, W. *J. Appl. Phys.*, **18**, 530–44 (*June*, 1947).—The absolute energy of the light, its spectral distribution, and the efficiency of conversion from X-rays to light have been determined by comparison with a standard W filament lamp. Equations are given for determining the distribution of light in the diffusing screen material, and calculation of the light losses are made for varying screen thickness and X-ray absorption. Allowance for scattering and secondary X-radiation was made and a conversion efficiency of 5% obtained for this phosphor. A.

535.372 : 535.43 : 538.615 2511

The Zeeman-effect and the intensity and polarization of resonance and fluorescence radiation. KASTLER, A. *Physica, 's Grav.*, **12**, 619–26 (*Dec.*, 1946).—Experiments with polarized light are discussed, showing the connection between these phenomena. L. P.

535.372 : 535.43 : 551.510.3 = 4 2512

The problem of the luminescence of the sodium *D*-lines in the high atmosphere. KASTLER, A. *Physica, 's Grav.*, **12**, 615–18 (*Dec.*, 1946) *In French.*—The author proposes to determine the % polarization of these lines in order to decide whether they arise because of optical resonance, or are due to luminescence excited by ultra-violet rays. L. P.

535.372–31 : 535.343.2 = 4 *see Abstr.* 2500

535.375.5 2513

Photo-electric intensity measurements of Raman spectra. CHIEN, J.-Y., AND BENDER, P. *J. Chem. Phys.*, **15**, 376–82 (*June*, 1947).—An instrument for the direct photo-electric recording of Raman spectra of liquids is described together with the results obtained for CCl_4, $CHCl_3$, CH_2Cl_2, and C_6H_6. The precision of the results was tested by eight recorded spectrograms of $CHCl_3$. The intensity ratios of anti-Stokes to Stokes lines were found to be in good agreement with theoretical values. Approximate values of the change of the bond polarizability of the C–Cl bond in CCl_4 and the C–H bond in C_6H_6 caused by valence vibrations are calculated from the intensity data. A.

535.375.5 = 4 2514

Raman spectra of pentatomic tetrahedral molecules. I. DELWAULLE, M. L., AND FRANÇOIS, F. *J. Phys. Radium* (*Sér.* 8) **7**, 15–32 (*Jan.*, 1946) *In French.*—The spectra of a large number of molecules of the types AX_4, AX_3Y, AX_2Y_2, AX_2YZ and AXYZT are investigated, degrees of depolarization as well as frequencies being determined. Some of the compounds have not been studied before. The results are compared critically with those of earlier workers. L. A. W.

535.375.5 = 4 2515

Raman spectra of pentatomic tetrahedral molecules. II. DELWAULLE, M. L., AND FRANÇOIS, F. *J. Phys. Radium* (*Sér.* 8) **7**, 53–8 (*Feb.*, 1946) *In French.*—From a consideration of their measurements published in I, the authors put forward schemes explaining the evolution of the spectra in series of related compounds. L. A. W.

535.375.5 : 535.343.2 2516

Raman spectrum of alumina and the luminescence and absorption spectra of ruby. KRISHNAN, R. S. *Nature, Lond.*, **160**, 26 (*July 5*, 1947).—Seven Raman lines are reported and a preliminary assignment made, which agrees with earlier theoretical predictions. The explanation of satellite lines in the ruby spectrum as due to combinations of Cr^{3+} electronic transitions with the vibration frequencies of the alumina lattice is confirmed.

535.375.5 : 535.343.2–15 : 535.375.5 : 539.11 = 4 *see Abstr.* 2603

535.375.5 : 535.8 *see Abstr.* 2534

535.375.5 : 539.13 : 539.155.2 : 535.343.3 *see Abstr.* 2501

535.39 2517

Technique for obtaining exceptionally durable low reflecting films of MgF_2 on glass. TYLER, J. E. *Rev. Sci. Instrum.*, **18**, 367–8 (*May*, 1947).

535.41 : 535.339.3 = 4 2518

On the selective reflecting power of Lippmann plates and their use in monochromators. MERLAND, A., AND SCHONNE, P. *C.R. Acad. Sci., Paris*, **224**, 1105–8 (*April* 14, 1947) *In French.*—To compare the luminosity and sensitivity of a Lippmann plate with customa monochromators, the selective reflection of the form has been measured. The Lippmann plate was immers in benzene in a transparent trough, the plate making small angle with the windows of the trough. On a phot graphic plate in a spectrograph were recorded: (1) t spectrum of light reflected off the air-glass surface of t window of the trough; (2) spectrum of light reflected o the Lippmann plate; (3) a comparison spectrum. It w found that (*a*) the reflecting power was greater when t gelatine side of the plate was the reflecting surface th when the glass side was used; (*b*) with thin gelatine (7 the highest reflectivity attained was 0·065, with ½-intensity width of the band of 126 Å; (*c*) with gelati 33 μ thick, the highest reflectivity was 0·21, and intensity width of 60 Å. A. C.

535.41 : 535.345.6 25

Reflection and transmission interference filters. HADLE L. N., AND DENNISON, D. M. *J. Opt. Soc. Amer.*, 3 451–65 (*June*, 1947).—The reflection filter consists of perfect mirror coated with a thin layer of dielectr material and a very thin metal film. Max. and mi reflection coeffs. are 100% and 0% respectively. T transmission filter has thin metal films on each side of dielectric layer, and has max. and min. coeffs. of 30–40 and ~1%. The theory is worked out on the basis Maxwell's equations in terms of the thickness a optical constants of the metal films. The formula for t reflection filter degenerates to a simple form for lo wavelengths (infra-red). The constants required for efficient transmission filter are approximately met by films in the visible region, but not in the u.v. or i The effect of oblique incidence is also treated.

535.421 : 535.312 25

Total internal reflection and Huyghens' construction: t immersion grating. ROGERS, G. L. *Nature, Lond.*, 16 25–6 (*July 5*, 1947).—Spectra were found to emerge in air at various angles from a glass-air surface illuminat at slightly > the critical angle when the surface w provided with a grating formed by strips of deposited A In this case the zero order spectrum (i.e. the transmitt beam) is suppressed. The theory and formulae are ou lined and the possibilities of the grating discussed.

535.43 25

Light scattering by spherical particles. SINCLAIR, *J. Opt. Soc. Amer.*, 37, 475–80 (*June*, 1947).—The M theory of light scattering by a spherical isotropic parti of any radius is briefly described. Equations are giv for the angular distribution of intensity, and for the to energy scattered by transparent particles or scattered a absorbed by absorbing particles. It is shown expe mentally and by comparison of the equations that bo the Mie and the Rayleigh equations for the angu distribution of intensity yield results which are too gr by a factor of 2 when the particle is illuminated by natu light. Graphs are included giving some of the results a recently published series of scattering calculatio A second factor of 2 occurs in the measurement of t scattering cross-section of very large spheres, wh scattering becomes analogous to diffraction. It is sho theoretically that when the radius of the sphere is at le 25× the wavelength, the scattering cross-section is tw the geometric cross-section. This result is confirm experimentally when the observation is made at a distar from the sphere sufficiently large for the diffracted li to be excluded from the measuring device.

535.43 = 4 25

Scattering of light in the neighbourhood of opti resonance. LENNUIER, R. *Ann. Phys., Paris* (*Sér.* 12)

–332 (*May–June*, 1947) *In French.*—Intensity and arization measurements were made upon the scattering Hg vapour (pressure $1\cdot85\times10^{-4}$ mm) of incident liation having frequencies ν_1 differing by about $^{-2}$ Å from the hyperfine components ν_0 of the resonance . The scattered spectra contain Rayleigh frequencies the duration of interaction being found to be $_0-\nu_1)^{-1}$ from the effect of a magnetic field on the arization. The scattered spectra also contain the onance frequencies ν_0, the corresponding time of eraction being the life-time of the resonance state. e observed phenomena, including the presence of an preciable proportion of incoherent radiation in the ttering, are considered theoretically. L. A. W.

5.43 : 535.561 : 549.514.51 2523

The scattering of light in quartz. CHANDRASEKHARAN, *Proc. Indian Acad. Sci. A*, **25**, 256–9 (*March*, 1947).—e effect of sending an intense beam of plane-polarized liation ($\lambda = 2\,537$ Å) along the optic axis of a perfectly nsparent sphere of quartz has been studied. Owing to e rotation of the plane of polarization of the radiation it traverses the crystal, the beam exhibits fluctuations in ensity when photographed from a transverse direction. ie distance from one dark band to the next represents rotation of 180° of the plane of polarization. The ect is due to diffusion of the light by atomic vibrations the crystal lattice. W. R. A.

5.43 : 538.615 : 535.372 *see Abstr.* 2511

5.43 : 551.510.3 : 535.372 = 4 *see Abstr.* 2512

5.43 : 551.593.5 = 82 *see Abstr.* 2729

5.43 : 615.849 : 537.531 *see Abstr.* 2573

5.43–15 2524

The longitudinal dispersion of infra-red rays in polystyrenes. LEPESCHKIN, W. W. *J. Phys. Coll. Chem.*, **51**, 8–75 (*May*, 1947).—This and the Tyndall effect in lid polystyrenes and solutions of polystyrenes have en recorded photographically. Neither solid polystyrenes in the form of transparent layers between glass ates, nor solutions in C_6H_6, C_6H_5Me, and CS_2 showed y Tyndall effect in dark red or infra-red rays. The ngitudinal dispersion is proportional to (mol. wt.)$^{\frac{1}{2}}$ of e polystyrene, and, for solutions, is related to refr. index the solvent. The dispersion is greater if the polystyrene molecules are oriented perpendicular to the rection of the incident radiation than if oriented rallel. These facts confirm the Neugebauer theory of ie longitudinal dispersion of light. W. R. A.

5.43–15 : 541.24 2525

Longitudinal dispersion of infra-red rays in optically npty and turbid media, and molecular weights of subances. LEPESCHKIN, W. W. *J. Phys. Coll. Chem.*, **51**, 5–84 (*May*, 1947).—Using the photographic method of bserving longitudinal dispersion of light the mol. wts f haemocyanin and serum proteins have been examined. he cube of the dispersion gives a direct measure of the ol. wt. for optically empty solutions, but the Tyndall ffect must be allowed for in the case of turbid solutions. his correction was made by measuring the Tyndall ffect of a suitable comparison suspension, and the actors governing the choice of suspension are discussed. t high intensity of dark red illumination, a slight Tyndall ffect was exhibited by the empty solutions, but the pparatus can be constructed so as to eliminate this error. ssuming the mol. wt. of ovalbumin to be 4×10^4, the ol. wts of haemocyanin, serum albumin, pseudoglobulin, and euglobulin are $6\cdot8\times10^6$, $6\cdot4\times10^4$, $\cdot3\times10^5$, and $1\cdot51\times10^5$, the *p*H of the solutions being aintained at the iso-electric point. W. R. A.

535.51 : 535.37 *see Abstr.* 2506

535.51–15 : 535.347 : 535.343.2 *see Abstr.* 2498

535.51–15 : 548.7 : 535.347 : 535.343.2 *see Abstr.* 2499

535.515 : 537.228.3 2526

On the heating effects in electrical double refraction. SNELLMAN, O. *Ark. Kemi. Min. Geol.*, **24 B** (*No.* 1) *Paper* 1, 6 *pp.* (1947).—The heat developed between two charged electrodes in a liquid is calculated. The resulting temp. gradient and its effect on the refr. index of the liquid between the plates is determined by methods analogous to Björnståhl's calculations for streaming double refraction. An expression for the cross-section of a light ray which can traverse the liquid without reflection against the electrodes is derived and some anomalies discussed. See Abstr. 893 (1944). H. G. J.

535,515 : 537.228.3 : 538.612 2527

Some remarks concerning the theory of double refraction in suspensions. SNELLMAN, O. *Ark. Kemi. Min. Geol.*, **24 B** (*No.* 1) *Paper* 2, 6 *pp.* (1947).—Details of some sources of error arising with magnetic and electric double refraction. A discussion of some of the theories and formulae of other workers in this field is given, and alternative formulae derived in connection with the intensity of light behind a lattice. See Abstr. 1530 (1909), 1278 (1926), 1518 (1914). H. G. J.

535.525 : 549.1 = 5 2528

Determination of the angle between the optical axes of minerals based on statistical measurements of retardation. FALINI, F. *Ric. Sci. Ricostruz.*, **15**, 390–2 (*Oct.–Nov.*, 1945) *In Italian.*—It can be shown that the probability of obtaining a section of given birefringence of a uni-axial crystal is a function of that birefringence, increasing with the value. In bi-axial crystals, the probability function varies with the angle of the optical axes. Thus the angle can be found from the distribution function of a discrete number of observations. Use can be made of phase-delay curves with thin plates of crystals. A graphical method is explained. J. A. W.

535.561 : 535.323 : 549.514.51 2529

The dispersion, birefringence, and optical activity of quartz. RADHAKRISHNAN, T. *Proc. Indian Acad. Sci. A*, **25**, 260–5 (*March*, 1947).—New formulae have been proposed for the ordinary and extraordinary refractive index, and rotatory power of a uniaxial crystal exhibiting optical activity. The formulae are valid with fair accuracy over a wider range of frequencies than those previously put forward. W. R. A.

535.561 : 549.514.51 : 535.43 *see Abstr.* 2523

535.65 : 612.845.5 *see Abstr.* 2739

535.66 : 537.531 : 548.0 *see Abstr.* 2687

535.662.2 : 549.514.51 : 548.0 *see Abstr.* 2688

535.8 2530

Stray light in optical systems. COLEMAN, H. S. *J. Opt. Soc. Amer.*, **37**, 434–51 (*June*, 1947).—An objective, photo-electric method was used to measure the stray light by comparing the contrast of an image with that of the object. Various systems were examined, and "contrast renditions" varying from 3 to 100% were found. The factors controlling contrast rendition are enumerated; for an object with uniform surround, it is independent of the field angle and the aberrations. Contrast rendition is generally the most important factor in range limitation of telescopes, and some tests with specific instruments confirmed the evaluation based on Hardy's [Abstr. 2318 (1946)] and Blackwell's [Abstr. 1089 (1947)] researches. A.

535.8 2531

Recent and unusual German lens designs. KAPRELIAN,

E. K. *J. Opt. Soc. Amer.*, **37**, 466–71 (*June*, 1947).—Some of the unusual lenses in the Carl Zeiss collection and those found in captured German equipment are shown diagrammatically, and constructional formulae and performance data are supplied. Most of the lenses fail to fall in any of the usual classifications. Wide angle types include an $f:2\cdot8$ distortionless objective and a 210° objective of the reversed telephoto type. The long focus objectives include the 300 cm $f:25$ telephoto lens used in the FK 3-m infra-red camera for photographing England from the French Coast. Wide aperture types include modifications of the triplet, Gauss and Sonnar types. Among these are objectives of $f:1$ and $f:1\cdot5$ aperture used in the Bildwandler (infra-red image convertor), and which possess focal lengths of from 9 to 40 cm. Experimental objectives utilizing one or more aspherical surfaces are described. References are made to the appropriate prior art. A.

535.8 2532

A photoelectric lens bench. HERRIOTT, W. *J. Opt. Soc. Amer.*, **37**, 472–4 (*June*, 1947).—The spatial distribution of energy in the image of a lens under test is displayed on a cathode-ray oscillograph, by scanning the image with a vibrating slit, and using a photo multiplier photo cell. A.

535.8 : 535.317.9 : 621.397 2533

Method of computing correction plate for Schmidt system for near projection, with special reference to system for television projection. FRIEDMAN, H. S. *J. Opt. Soc. Amer.*, **37**, 480–4 (*June*, 1947).

535.8 : 535.375.5 2534

Theory of condensing lenses for Raman tubes of small volume. NIELSEN, J. R. *J. Opt. Soc. Amer.*, **37**, 494–9 (*June*, 1947).—The author's calculations [Abstr. 1553 (1931)] are extended to cover the case when the extension of the source in the direction of the spectrograph slit $\leqslant$ the length of the slit. The former dispositions for max. optical efficiency are shown still to hold, but certain special arrangements may be found advantageous. A.

535.81 : 535.317.9 *see Abstr.* 2477

535.822 2535

Phase-contrast methods in microscopy. MARTIN, L. C. *Nature, Lond.*, **159**, 827–30 (*June* 21, 1947).—A brief description of the principle of the method, using vector diagrams. Some practical points are discussed, and recent and future developments indicated. Fringes and haloes formed by light scattered in thick objects are complex, and not easily analysed.

535.822 2536

Production of contrast in the microscope image by means of opaque diaphragms. HALLIMOND, A. F. *Nature, Lond.*, **159**, 851–2 (*June* 21, 1947).—Methods analogous to the phase-contrast methods are outlined, in which rays deviated by inclined surfaces in the object are eliminated from the image-forming pencil by opaque stops, the weakening of the background being thereby avoided. The opacity must be limited in area to the immediate vicinity of the annular ring conjugate with that beneath the condenser, otherwise the aperture is reduced and the resolving power damaged. Several photographs illustrative of the method are given.

535.822 2537

A variable phase-contrast system for microscopy. HARTLEY, W. G. *Nature, Lond.*, **159**, 880–1 (*June* 28, 1947).—At the back focus of the microscope, used with plane-polarized light, was placed a mica $\lambda/4$ plate whose centre zone was rotated 90° with respect to the outer zone. The diffracted rays from the object thus received a phase difference with respect to the dioptric ray passing through the centre, which could be varied b rotating the plate. Some resulting photographs ar shown.

535.88 : 621.397.6 : 535.317.9 *see Abstr.* 2478

HEAT 536

536.21 = 4 253

The cooling of a non-homogeneous body. DATZEFF, *C.R. Acad. Sci. URSS*, **55** (*No.* 2) 111–14 (1947) *French.*—Given any initial temperature distribution two semi-infinite thin bars in contact at their ends, th general solution for the temp. distribution at any time du to thermal conduction is obtained. F. E. I

536.24 : 621–71 = 5 253

Perforations as cooling or heating elements. POGGI, *Ric. Sci. Ricostruz.*, **15**, 257–60 (*Sept.*, 1945) *In Italian.*—[Abstr. 2128 B (1947)].

536.241 : 621.791.75 = 82 254

A theory of the propagation of heat in arc weldin RIKALIN, N. N. *Bull. Acad. Sci. URSS, Dep. Sci. Tec* (*No.* 1) 61–82 (1947) *In Russian.*—[Abstr. 2366 B (1947)

536.242 254

On heat delivery by a cylinder in a potential flo CHERPAKOV, P. V. *C.R. Acad. Sci. URSS*, **52** (*No.* 399–400 (1946).—Formulae are given for the heat give up by a heated infinite cylinder immersed in a gas. Thes are convenient for computation. L. S. G

536.242 : 541.128.1 254

Heat transfer between a fluid and a porous solid generatin heat. BRINKLEY, S. R., JR. *J. Appl. Phys.*, **18**, 582– (*June*, 1947).—Anzelius' theory is extended to include th case where the solid generates heat. Expressions ar obtained for the temp. of solid and fluid as functions position and time, in the case that the heat source functio is a linear function of the temp. of the solid, independen of position and time. The application of the theory to description of the temp. in catalytic reactions is indicate

536.252 : 532.517.4 254

Theoretical and empirical expressions for heat transf in two-dimensional turbulent flow. KAPITZA, P. *C.R. Acad. Sci. URSS*, **55** (*No.* 7) 591–7 (1947).—Fro theoretical considerations, the customary simple em pirical expression for K_h, the so-called heat transf number in pipes of circular cross-section, is deduced the form $K_h = 0\cdot0396(Re)^{-0\cdot25}(Pr)^{-0\cdot57}$ (Re and P are respectively the Reynolds and Prandtl numbe relating to the flow). Rounding off the values of th constants by a consideration of experimental results, it suggested that the expression $K_h = 0\cdot04(Re)^{-0\cdot}$ $(Pr)^{-0\cdot6}$ is satisfactory for practical use. For high R it is suggested that $K_h = (\gamma/2)(Pr)^{-0\cdot6}$, and that the coef of skin-friction, γ, be derived directly from well-know experimental results. In rough tubes, it is suggeste that, for any Re, $K_h = (\gamma/2)(Pr)^{-0\cdot5}$. J. S. G. T

536.421 254

The λ-point of NH_4Cl and thermodynamic equilibria o the second order. HALL, E. O. *Phys. Rev.*, **71**, 916–1 (*June* 15, 1947).—Using Lype's thermodynamical equa tions [Abstr. 2587 (1946)] reasonable agreement wa found between the experimental and theoretical slope o the equilibrium curve for NH_4Cl at its λ-point. W. E. D

536.421 : 537.311.3 254

Determination of the order-disorder transition point i $FeNi_3$. KÄLLBÄCK, O. *Ark. Mat. Astr. Fys.*, **34 B** (*Pape* 17) 6 *pp.* (1947).—The resistance of an initially ordere

d 2·5 cm long and 0·08 cm square was measured tentiometrically as a function of increasing temp., the te of heating being slow enough to maintain equilium, and of decreasing temp., the rate of cooling c/min) being sufficient to retain the disordered state. ie transition temp. was ~506° and the Curie point 6°C. The resistance of the disordered alloy was about μΩ-cm > that of the ordered. A. J. C. W.

6.421.1 2546

Melting point bath liquids useful up to 440°C. WHITE, M. *Industr. Engng Chem.* (*Analyt. Edit.*) **19,** 432–3 *une*, 1947).

6.423 : 532.7 *see Abstr.* 2427

6.441 + 532.133 + 532.612.4 + 537.226.1 *see Abstr.* 2555

6.48 2547

On a connection between the fountain effect, second und and thermal conductivity in liquid He II. MEYER, , AND BAND, W. *Phys. Rev.*, **71,** 828 (*June* 1, 1947).— y assuming that in the absence of a constriction the untain effect is still present—its effect appearing as an ternal momentum—a relation is obtained between the cond sound velocity, the fountain effect coefficient, ie specific heat/cm³ and ε/m, where ε is the heat asciated with the mass m which is transported with the ternal momentum. This gives a curve for ε/m rising om zero at 0°K to the heat content at the λ-point (T_λ). he concentration of the liquid involved in the momen- $m = (T/T_\lambda)^6$. An equation for heat conductivity volving a damping term gives, on comparison with perimental data on conductivity, a relaxation time $\cdot 10^{-3}$ to 10^{-4} sec, becoming zero at the λ-point. W. E. D.

6.48 : 537.311.33 *see Abstr.* 2560

6.48 : 539.155.2 *see Abstr.* 2621

6.55 : 535.337 *see Abstr.* 2489

6.655 : 532.612.4 *see Abstr.* 2424

THERMODYNAMICS 536.7

6.7 : 531.19 : 541.123 2548

Configurations of closed ring molecules. MILLER, A. R. *roc. Camb. Phil. Soc.*, **43,** 422–8 (*July*, 1947).—The hysical significance of the parameters which appear in ie combinatory factors $g(N_i)$ and $g(N_i, X_{ij})$ in the atistical mechanics of mixtures is examined. Hitherto, osed ring molecules have been excluded from the irisdiction of the formulae for these combinatory ctors. The means by which this restriction on the alidity of the formulae can be removed is indicated. is concluded that the equations given by Guggenheim bstr. 968 (1945)] are formally applicable in all cases, rovided that appropriate values, which differ according s the molecules are simple and branched chain or closed ng, are substituted for certain parameters which occur the equations. A.

6.7 : 531.19 : 541.123.2 = 3 2549

Statistical derivation of the limiting laws of dilute olutions from differences of molecular volumes. SCHULZ, . V. *Z. Naturforsch.*, **2a,** 27–38 (*Jan.*, 1947) *In German.* —The entropy of mixture for a binary solution whose omponents have different mol. volumes has been atistically derived on the assumption that the molecules e spherical. It is found that the entropy of dilution is this case higher than for equality of molecular volumes. t small concentrations of the higher molecular comonent, the correction term is approximately that for the an der Waals volume correction. At vanishing conc., the equation for the osmotic pressure becomes that of van't Hoff. The osmotic and activity coefficients derived from the new entropy equation are found to be in good agreement with experimental data for protein solutions. Attempts to construct a lattice-like model for the statistical derivation of the properties of solutions have been unsuccessful. H. H. HO.

536.7 : 539.133 *see Abstr.* 2608

536.7 : 541.121 : 539.155.2 *see Abstr.* 2622

536.7 : 541.183.35 : 532.612.4 = 4 *see Abstr.* 2425

536.7 : 541.64 : 548.5 *see Abstr.* 2689

536.75 = 4 2550

Observations regarding the idea of entropy and on some formulae which follow from it concerning internal energy. POPOFF, K. *Ann. Phys., Paris* (*Sér.* 12) **2,** 195–208 (*March–April*, 1947) *In French.*—In the first part of the paper an attempt is made to separate the mathematical and physical parts in the idea of entropy and to discuss and extend the results of C. Carathéodory. It is shown that there is a unique integrating factor for the expression for the first law of thermodynamics, all other such factors depending upon the form of the equation of state and the internal energy as a function of the independent variables. The second part establishes formulae for differences of internal energy of a homogeneous system in terms of temperature and volume, and temperature and pressure. These formulae are analogous to those of Kirchhoff and are thought to be original. F. E. H.

536.752 : 531.19 : 530.145 *see Abstr.* 2411

ELECTRICITY 537

537.1 : 531.51 : 530.12 = 3 *see Abstr.* 2403

537.1 : 531.51 : 530.145 = 4 *see Abstr.* 2412

537.212 : 534.213.4 : 621.392 2551

The electrostatic field of a point charge inside a cylinder, in connection with waveguide theory. BOUWKAMP, C. J., AND DE BRUIJN, N. G. *J. Appl. Phys.*, **18,** 562–77 (*June*, 1947).—The field is calculated by 3 methods, the case of an axial point charge being treated in detail. The third method is shown to be useful in questions of waveguide propagation, as the fields in far zones can be calculated from that in the immediate neighbourhood of the exciting source. An acoustic example is given. A.

537.226 2552

Curie point of barium titanate. HARWOOD, M. G., POPPER, P., AND RUSHMAN, D. F. *Nature, Lond.*, **160,** 58–9 (*July* 12, 1947).—A co-existence temp. range of the cubic and tetragonal forms [Abstr. 1394 (1946)] between 122° and 129°C has been found, coinciding with the peak of the permittivity curve and a specific heat change of ~0·0025 cal/g.deg. With rapid cooling through the transition region, transient permittivity values considerably > the peak were observed, and attributed to a finite transition time between the two phases.

537.226 : 537.228.1 2553

Dielectric and piezoelectric properties of barium titanate. ROBERTS, S. *Phys. Rev.*, **71,** 890–5 (*June* 15, 1947).— The permittivity and loss of Ba titanate and Ba–Sr titanate have been measured at biasing field strengths from 0 to 5 MV/m, at temps. from −50°C to +135°C and at frequencies from 0·1 to 25 Mc/s. The measurements *v.* temp. indicate the expected agreement with the Curie–Weiss law at temps. < the Curie point. Measurements *v.* field strength indicate that the electric field intensity can be expressed as a simple function of the electric displacement, consisting of a linear and a cubic term. At temps. < the Curie point the results are more

complicated, presumably because there are spontaneously polarized domains which give rise to hysteresis and remanence. At field strengths low enough to avoid hysteresis and remanent polarization, no anomalies in the dielectric characteristics *v.* frequency have been observed. When polarized, however, by a momentary application of a strong d.c. field, a resonance spectrum appears in these ceramics, attributed to a piezo-electric effect which exists only in the polarized samples. The piezo-electric voltage developed upon squeezing a polarized specimen of barium titanate has been measured directly with a vacuum tube electrometer. Both the longitudinal and transverse effects have been observed. A.

537.226 : 621.315.612.4 2554

The effective permittivity of compressed and sintered samples of TiO_2. STEVELS, J. M. *Rec. Trav. Chim. Pays-Bas*, **66**, 71–4 (*Jan.–Feb.*, 1947).—Measurements of the samples are examined in the light of the theoretical formulae for mixtures of solid substances and air [Abstr. 109–10 (1947)]. The values of effective permittivity are very dependent on the degree of sintering, which governs the shape of the air-spaces in the material. It is concluded that the air-spaces are disc-shaped in the case of unsintered samples, and become more and more nearly spherical the more the samples are sintered. E. R.

537.226.1 + 532.133 + 532.612.4 + 536.441 2555

Dielectric constant, viscosity, surface tension, and critical data of boron tribromide, dioxan, and ethylene dichloride. HØJENDAHL, K. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 2) 12 *pp.* (1946).

537.226.8 : 548.0 = 4 2556

Study of the low-temperature dielectric properties of some crystals. LION, R. *Ann. Phys., Paris*, **17**, 324–33 (*June–July–Aug.*, 1942) *In French.*—The variation with temp. of the permittivity and electric absorption in the range 20°–250°K was measured for about 25 crystal powders. Most showed only a gradual decrease with temp. The behaviour of $KMnO_4$ and NH_4Cl . $MgCl_2$ could be explained qualitatively by the presence of simple dipoles. Spontaneous polarization below certain temperatures had to be assumed to explain the more complex behaviour of KH_2PO_4, KH_2AsO_4 and $K_3Fe(CN)_6$. KNH_4SO_4 . $2H_2O$ probably has a 2nd-order phase change at about 210°K. A. J. C. W.

537.228.1 : 537.226 *see Abstr.* 2553

537.228.1 : 621.317.36 2557

The approximate determination of piezo-electric properties by measurements on small crystals. BURSTEIN, E. *Rev. Sci. Instrum.*, **18**, 317–27 (*May*, 1947).—[Abstr. 2216 B (1947)].

537.228.1 : 621.396.611.21 = 82 2558

Piezoelectric crystals and their application. ANDREEV, N. N. *Elektrichestvo* (*No.* 2) 5–13 (1947) *In Russian.*—[Abstr. 2332 B (1947)].

537.228.3 : 535.515 *see Abstr.* 2526

537.228.3 : 538.612 : 535.515 *see Abstr.* 2527

ELECTRIC CURRENTS 537.3

537.311 : 539.164.92 *see Abstr.* 2637

537.311.3 : 536.421 *see Abstr.* 2545

537.311.31 : 539.234 = 4 *see Abstr.* 2661

537.311.33 2559

Erratum: Transition from classical to quantum statistics in germanium semiconductors at low temperature. JOHNSON, V. A., AND LARK-HOROVITZ, K. *Phys. Rev.*, **71**, 909 (*June* 15, 1947).—See Abstr. 1525 (1947).

537.311.33 : 536.48 2560

Resistance of PbS close to absolute zero. DUNAEV, J. A. *C.R. Acad. Sci. URSS*, **55** (*No.* 1) 21–4 (1947).—The resistance of 3 PbS samples (one a single crystal) was measured from 950°K to 2·2°K, and the Hall effect at the higher temperatures. No superconductivity was found, but the resistance fell to a low const. value at low temp. It is concluded that PbS is not a semi-conductor in which the number of carriers is due solely to thermal motion. D. S.

537.311.33 : 539.217 = 3 *see Abstr.* 2660

537.311.33 : 621.315.59 2561

Conductivity hysteresis of dust deposits. GOLDSCHMIDT, K. *Nature, Lond.*, **159**, 815–16 (*June* 14, 1947).—[Abstr. 2173 B (1947)].

537.311.33 : 621.383.4 : 621.315.59 : 621.385.1 2562

A theory of flicker noise in valves and impurity semiconductors. MACFARLANE, G. G. *Proc. Phys. Soc. Lond.*, **59**, 366–75 (*May*, 1947).—[Abstr. 2282 B (1947)].

537.312.62 2563

The structure of superconductors in the intermediate state. II. MESHKOVSKY, A., AND SHALNIKOV, A. *J. Phys. USSR*, **11** (*No.* 1) 1–15 (1947).—The structure of the intermediate state was studied by measuring the variations of magnetic field in a gap between two Sn hemispheres with very small Bi probes. The distribution was found to correspond to a somewhat irregular mixture of superconducting and normal phases, which differed according to whether the temp. had been lowered in const. magnetic field, or the field varied at const. temp. Contrary to the suggestion of earlier experiments using a larger B probe, the variations of field persisted even when the gap was large. This is not in agreement with Landau's prediction [*J. Phys., USSR*, **7**, 99 (1943)] that there should be a small critical width of gap beyond which the field variations disappear, corresponding to a much more intimate mixture of the phases at the gap surfaces. D. S.

537.312.62 : 538.522.3 2564

On the non-linearity of electromagnetic processes in superconductors. GINSBURG, V. *J. Phys., USSR*, **11** (*No.* 1) 93 (1947).—In magnetic fields near the critical value the kinetic energy of the induced super-current becomes comparable with the excitation energy into the normal state. The number of superconducting electrons will therefore be diminished. This introduces non-linearity into London's equation, curl $(m/ne^2)\vec{J} = -\vec{H}/c$. If the primary coil of a mutual inductance with a superconducting core is fed with a sinusoidal current, odd harmonics will be produced in the secondary when the magnetic field is near its critical value. H. L.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.523 : 537.564 : 621.315.618.015.5 = 82 2565

Dielectric strength of gases. GOKHBERG, B. M. *Bull. Acad. Sci. URSS, Sér. Phys.*, **10** (*No.* 4) 425–33 (1946) *In Russian.*—Measurements of the first Townsend ionization coefficient α for a number of gases of widely varying dielectric strengths show that the breakdown fields are those for which α reaches a value $\sim 0{\cdot}0215 \times$ the pressure (in mm Hg). The practical applications of gases with high breakdown strength are discussed. D. S.

537.525 : 542.921.9 *see Abstr.* 2682

537.525.4 2566

Concerning estimates of the minimum sparking potential based upon the cathode work function. HALE, D. H., AND HUXFORD, W. S. *J. Appl. Phys.*, **18**, 586 (*June*, 1947).—See Abstr. 1532 (1947). It is pointed out that the

ods adopted for the determination of γ_m are un-
ble, and in fact the values reported conflict with
of other investigators. Several exceptions to the
relating work function and sparking potential are
ated.

527.5 2567

**milarity of high-pressure discharges of the convection-
lized type.** ELENBAAS, W. *Philips Res. Rep.*, **1**, 60 (*Nov.*, 1946).—A detailed theoretical description imilarity conditions [see Elenbaas, Abstr. 1172 B 5)] for high pressure discharges in a given gas and in rent gases stabilized by (*a*) free convection, and forced convection. Discharges in closed tubes are discussed, and the theories are compared with riment. J. D. C.

527.5 2568

**a convection in the super-high pressure mercury dis-
ge.** ROKHLIN, G. N. *C.R. Acad. Sci. URSS*, **55** 5) 399–402 (1947).—The effects of convection on the acteristics of high-pressure Hg-vapour arcs were stigated by studying the voltage gradient, light ssion, and current density of stationary and freely-ng arcs. In the latter case convection was eliminated, ch resulted in a drop in arc temp. from 8 200 to 0°K, with a corresponding increase in the luminous ime. These effects are qualitatively discussed. J. D. C.

.531 : 535.33 = 4 2569

tudy of the satellites of the L_α radiation of gold.
MENTO, J. *Portugal. Phys.*, **2** (*No.* 2) 139–48 (1946) *French.*—A Cauchois spectrometer with a bent rtz crystal was used to photograph the *L* spectrum Au, and the intensity distribution in the L_α group recorded with a Zeiss microphotometer. Both L_{α_1} L_{α_2} were asymmetric, with tails on the high-frequency s. The deviations from symmetry are in qualitative ement with the calculated satellite band [Abstr. 2–3 (1937)]. A. J. C. W.

.531 : 535.33 2570

**oft X-ray *K*-absorption and emission spectra of Mg,
Si and their oxides.** DAS GUPTA, K. *Indian J. Phys.*, 226–38 (*Dec.*, 1946).—The spectra were studied both absorption and in emission by means of an evacuated at-crystal spectrometer. For the elements the steepest t of the absorption edge coincides with the steepest t of the emission band. The absorption however ches its greatest value for X-rays of energies 3–4 eV ther than the short-wavelength limit of the emission nd, and begins 1–2 eV lower than the maximum of emission band. The absorption edges in the oxides about 10 eV higher than the emission bands. The ults are discussed in the light of zone theory. A. J. C. W.

7.531 : 535.33 = 4 2571

***L*-spectra and characteristic levels for osmium.** CAU-
OIS, Y., MANESCU, I., AND LE BLAU, A. *C.R. Acad.* , *Paris*, **222**, 1383–4 (*June* 12, 1946) *In French.*— bles of the wavelengths in the absorption and emission ectra, and tables of the characteristic levels are given. L. S. G.

7.531 : 535.338 : 621.385.83 2572

Note on the 2·8 MeV betatron. LASICH, W. B., AND DDIFORD, L. *J. Sci. Instrum.*, **24**, 177–9 (*July*, 1947).— bstr. 2291 B (1947)].

7.531 : 535.36 : 532.122 = 4 *see Abstr.* 2420

7.531 : 535.43 : 615.849 2573

**The intensities of direct and scattered X-radiation in a
rizontal water sheet exposed to a cylindriform beam of
ft vertical X-rays.** DE WAARD, R. H. *Proc. K. Ned. kad. Wet.*, **50** (*No.* 6) 672–83 (1947).—The variation of dose with depth is deduced. Homogenous radiation and distribution of scattered radiation according to the formula of J. J. Thompson are assumed. A comparison with some experimental results for $\lambda = 0{\cdot}36$ and $0{\cdot}55$ Å is made. H. M.

537.531 : 535.66 : 548.0 *see Abstr.* 2687

537.531 : 537.56 *see Abstr.* 2585

537.531 : 578.088.5 : 621.386.1 2574

High intensity source of long wavelength X-rays.
ROGERS, T. H. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 236–41 (*March*, 1947).—[Abstr. 2045 B (1947)].

537.531 : 621.386.2 = 4 2575

Spatial distribution of X-rays from some anticathodes.
MALLET, L., AND MAURIN, R. *Bull. Soc. Franç. Élect.*, **6**, 660–8 (*Dec.*, 1946) *In French. Transla. in Radiology*, **48**, 628–32 (*June*, 1947).—[Abstr. 2296 B (1947)].

537.531 : 771.534 *see Abstr.* 2744

537.533 = 4 2576

**An example of double secondary emission between plane
electrodes.** PAUTHENIER, M., DEMON, L., AND LAURENT, E. *C.R. Acad. Sci., Paris*, **222**, 1339 (*June* 3, 1946) *In French.*—A discussion of the secondary emission which may be set up between plane parallel electrodes, covered with a porous insulating material, when an ionization current passes for a very short time. L. S. G.

537.533.1 : 621.385 2577

**Influence of space charge on thermionic emission
velocities.** KLEMPERER, O. *Proc. Roy. Soc. A*, **190**, 376–93 (*Aug.* 12, 1947).—[Abstr. 2279 B (1947)].

537.533.73 : 548.74 = 3 *see Abstr.* 2706

537.533.9 : 535.2 2578

Radiation from electrons in a synchrotron. ELDER, F. R., GUREWITSCH, A. M., LANGMUIR, R. V., AND POLLOCK, H. C. *Phys. Rev.*, **71**, 829–30 (*June* 1, 1947).—By observing tangentially to the electron orbit a brilliant white spot of light can be seen, polarized with its electric vector parallel to the plane of the orbit. W. E. D.

537.533.92 : 537.56 *see Abstr.* 2586

537.534.72 : 545.827 2579

**An a.c. operated mass spectrograph of the Mattauch
type.** SHAW, A. E., AND RALL, W, *Rev. Sci. Instrum.*, **18**, 278–88 (*May*, 1947).—A mass spectrograph for chemical analysis of solid samples has been developed. The Mattauch arrangement of a 31° 50′ electric deflection followed by a 90° deflection in a magnetic field was used in order to obtain a large mass range in focus on one plate. The accelerating and deflecting voltages, and the current for the electromagnet were obtained from stabilized rectifier circuits connected to the 60 c/s supply. The electromagnet with 100 mA gave a field of 18 800 gauss across a $\frac{1}{8}$-in gap. During the introduction of the plate or insertion of new electrodes a gate valve was closed to isolate the spectrograph from the pumping system. In this way, different samples could be examined rapidly. The ion source was energized by a compact Tesla transformer wound on Lucite cylinders. One exposure covered a mass range from any mass *M* to a mass 10*M*. A.

537.534.72 : 621.385.82 2580

A space-charge lens for the focusing of ion beams.
GABOR, D. *Nature, Lond.*, **160**, 89–90 (*July* 19, 1947).—A suggested arrangement for production of a uniform electron space-charge cloud surrounding the axis of a cylinder is described, two opposed coils surrounding the cylinder providing a suitable magnetic field to maintain equilibrium. It is shown that the cloud will have a much more powerful focusing action for ion beams than would

the coils by themselves, and the focal length only increases as the first power of the ion energy, compared to the second for magnetic lenses, and the fourth for electrostatic "single" lenses.

537.542 : 537.564 2581

Time lags in Geiger–Mueller counter discharges. MONTGOMERY, C. G., AND MONTGOMERY, D. D. *Rev. Sci. Instrum.*, **18**, 411–14 (*June*, 1947).—The probability of the occurrence of a time lag in a counter discharge is expressed in terms of the probability of capture of an electron by an O_2 molecule, which is shown to be independent of the number of electrons produced and to correspond to a value for the capture cross-section in agreement with direct determinations. A.

537.542 : 537.591 2582

All-metal fast Geiger counters for cosmic-ray research. REGENER, V. H. *Rev. Sci. Instrum.*, **18**, 267–70 (*May*, 1947).

537.56 2583

Ionization yield of radiations. II. The fluctuations of the number of ions. FANO, U. *Phys. Rev.*, **72**, 26–9 (*July* 1, 1947).—[For I, see Abstr. 2902 (1946)]. The ionization produced by individual fast charged particles is frequently used as a measure of their initial energy; fluctuation effects set a theoretical limit to the accuracy of this method. Formulae are derived here to estimate the statistical fluctuations of the number of ions produced by constant amounts of particle energy. The variance of the number of ionizations is found to be 2 or 3 times $<$ if this number were governed by a Poisson distribution. An improved understanding is gained of the statistical treatment of fluctuation phenomena. A.

537.56 : 535.336.2 2584

On the mass spectra of hydrogen and deuterium. STEVENSON, D. P. *J. Chem. Phys.*, **15**, 409–11 (*June*, 1947).—On the basis of reasonable assumptions with regard to the probabilities of electron-impact-induced transitions of H_2 and D_2, it is calculated that the relative intensity of H^+ in the mass spectrum of H_2 should be 2·3 times $>$ that of D^+ in the mass spectrum of D_2 for ionization by electrons of $<$35 eV. This value is compared with experimental values 2·8 (22 eV), 1·5 (30 eV), 1·9 (50 eV), and 2·2 (100 eV). A.

537.56 : 537.531 2585

Absolute sensitivity of a graphite ionization chamber. LAX, M. *Phys. Rev.*, **72**, 61–7 (*July* 1, 1947).—A thick-walled graphite ionization chamber is suggested as a simple instrument for measuring the total intensity in the X-ray beam emitted by the betraton. The chamber would consist of two layers of C, each $\sim\frac{1}{3}$ of a radiation length, or 4·5 cm, thick, separated by a thin gas layer whose width is not critical. The absolute sensitivity of the ionization chamber is computed to an accuracy of $\sim$5% by comparison with the ionization which would be produced in an infinite C block. A.

537.56 : 537.533.92 2586

Ionization of mercury by electron impact. YAVORSKY, B. *C.R. Acad. Sci. URSS*, **55** (*No.* 4) 307–10 (1947).—The theoretical cross-section for this process is calculated using approximate wave functions for the Hg and Hg^+ atoms. The results are compared with the experiments of Smith [Abstr. 2782 (1931)] and Nottingham [Abstr. 1334 (1939)] and are in fair agreement with the latter but show a more pronounced maximum. W. E. D.

537.561 2587

Critical ionization potentials of uranium hexafluoride and hydrogen fluoride. WHITE, J. R., AND CAMERON, A. E. *Phys. Rev.*, **71**, 907 (*June* 15, 1947).—The ionization potentials of the various fluorides from UF_5 UF and of HF were measured, using an ion gauge a mass spectrometer, and taking the first ionization pot tial of Hg as standard. The results are tabulated. W. E.

537.564 : 537.542 *see Abstr.* 2581

537.564 : 621.315.618.015.5 : 537.523 = 82 *see Abstr.* 25

537.568 : 523.78 : 551.510.535 *see Abstr.* 2719

537.583 25

Surface ionization of thin layers of calcium and m nesium oxides. DOBRETZOV, L. N., STARODUBTZEV, S. AND TIMOKHINA, J. I. *C.R. Acad. Sci. URSS*, **55** (*No.* 303–6 (1947).—It is known that layers of some elemen such as Ca and Mg, on a W filament do not give posit ion currents in agreement with the Langmuir–Sa formula. By depositing a layer of either MgO or C on the W before depositing the element itself, it was sho that the positive ion emission decreased with increas thickness of the oxide, and that it was immaterial whet the Mg and Ca were deposited on their own oxide or the oxide of the other. Cd, Bi and Pb deposited o either MgO or CaO gave very little emission even at hi temps., whereas, according to the Langmuir–Sa relation, Pb should give a greater emission than Mg. W. E.

537.583 : 621.385.032.216 25

Oxide cathodes. The effect of the coating-core interf on conductivity and emission. WRIGHT, D. A. *Pr Roy. Soc. A*, **190**, 394–417 (*Aug.* 12, 1947).—[Abs 2281 B (1947)].

COSMIC RAYS 537.591

537.591 : 537.542 *see Abstr.* 2582

537.591 : 550.423 : 539.167.3 *see Abstr.* 2642

537.591 : 621.318.572 25

A pulse timing circuit for cosmic-ray research. TIC H. K. *Rev. Sci. Instrum.*, **18**, 271–8 (*May*, 1947). [Abstr. 2247 B (1947)].

537.591.1 25

On the existence of particles with a mass intermedi between those of mesotron and proton. ALICHANIAN, A ALICHANOW, A., AND WEISSENBERG, A. *J. Phys., USS* **11** (*No.* 1) 97–9 (1947).—A hodoscope counter array conjunction with a magnetic field and Pb absorbers w used to study the momentum-range properties of t non-electronic component of cosmic rays at altitu 3 250 m. It was found that 10–12% of particles wi momentum $>$180 MeV/c fail to penetrate 5·4 cm P Reasons are advanced for supposing these particles n to be protons. J. G.

537.591.1 25

The production of nucleons by the cosmic radiatio KORFF, S. A., AND HAMERMESH, B. *Phys. Rev.*, **71**, 842 (*June* 15, 1947).—The production of protons a neutrons at 14 156 ft by cosmic radiation was studi with the aid of proportional counters. More than o neutron at a time was found to be produced. T rate of occurrence of multiple neutron productions w found to be much less frequent than that of sing neutrons, even taking the usual distribution into accoun The number and rate of production of protons was al determined and was found to be roughly the same that of the neutrons.

537.591.15 25

Study of atmospheric showers. ALICHANIAN, A ASATIANI, T., AND MUSKHELISHVILLI, G. *J. Phys., USS* **11** (*No.* 1) 16–22 (1947).—In a threefold-coincide counter array recording atmospheric showers at 3 250

ude, the plan area of one large counter was covered hodoscope of 11 small subsidiary counters. Particle sity as a function of counter separation was studied, also the spread of particle density under a thick Pb en. A shower formation—"narrow showers"—ch is penetrating and apparently distinct from the er cascades was identified. J. G. W.

591.15 2594

ncrease of cosmic ray showers with altitude. ZHDANOV, 3., AND LIUBIMOV, A. L. *C.R. Acad. Sci. URSS*, **55** . 2) 115–16 (1947).—A triangular shower-recording ater array in which the scale of the counter separation varied fourfold was used under 0·6 cm and under m Pb at altitudes 900, 3 860 and 5 000 m. The rate ncrease of counting rate with altitude for the various ngements is discussed. J. G. W.

591.15 2595

osmic-ray bursts and shower spread under large knesses of lead. JURITZ, J. W. F., AND MOHR, C. B. O. *c. Roy. Soc. A*, **190**, 426–34 (*Aug.* 12, 1947).—The quency of occurrence of cosmic-ray bursts under ge thicknesses of Pb and Fe has been measured as a ction of the thickness, using a small ionization mber with and without shielding material round its s. Experiments have also been carried out with two ull chambers side by side, the frequency of occurrence bursts simultaneously in both chambers being observed ler different thicknesses of Pb. While the burst-y/thickness curves are, on the whole, fairly flat beyond first max., there are indications of a second max. at ge thicknesses in the case of Pb. From the experi-ntal results information has also been obtained about mean and the max. angular spread of showers, and the rease in shower spread with increasing size of shower. A.

.591.15 2596

Further cosmic-ray experiments above the atmosphere. LIAN, S. E., AND KRAUSE, E. H. *Phys. Rev.*, **71**, 918–19 ne 15, 1947).—In a V-2 rocket experiment, counters e arranged so that the fraction of particles penetrating 5 and 12 cm of Pb could be determined. Counters for istering rocket showers were shielded from showers electronic origin, but this increased shielding compared h an earlier experiment had the effect of doubling the aber of showers, thus indicating their non-electronic gin. Details of the arrangement of the counters are en. W. E. D.

MAGNETISM 538

3.11 2597

Absolute rotation and a rotating magnet. HSÜ, C.-P. reless Engr, **24**, 185–7 (*June*, 1947).—The two topics cussed are well known; the first amounts to the dis-ssion of rotating axes in dynamics leading to the roduction of the Coriolis and centrifugal fields of force. e second is a discussion of the electric polarization of nagnet rotating in its own field. [The statement made t a negative charge is produced on the axis of rotation ncorrect.] V. C. A. F.

3.22 = 5 2598

Research on the magnetic properties of calcium ferrites. RILLI, V. *Ric. Sci. Ricostruz.*, **15**, 388–9 (*Oct.–Nov.*, 45) *In Italian.*—CaO . Fe_2O_3 and 2CaO . Fe_2O_3 are th ferromagnetic, with Curie pt. about 360°. Mixtures CaO–Fe_2O_3 (1 : 1, 2 : 1), heat-treated up to 1 000° ve susceptibility/temp. curves showing a steep ascent m 550°–900°. The results of X-ray examination are cussed. J. A. W.

538.24 2599

Gyromagnetic resonance in ferrites. SNOEK, J. L. *Nature, Lond.*, **160**, 90 (*July* 19, 1947).—Rapid fall of permeability and rise of loss angle between B and H as the frequency is raised above a certain value were observed with certain ferrites, and suggested a resonance with the precession frequency of the spins round the direction of the internal field. Observed quantities agree approx. with theory [Abstr. 5226 (1935)].

538.242 : 539.32 *see Abstr.* 2664

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.3 : 530.145 *see Abstr.* 2413

538.52 2600

Aperiodic magnetisation of a sphere. CHERNY, F. B. *C.R. Acad. Sci. URSS*, **55** (*No.* 3) 211–14 (1947).—Solution of the Maxwell equations for the instantaneous appearance and disappearance of a uniform (constant) magnetic field round a conducting sphere. N. F. A.

538.522.3 : 537.312.62 *see Abstr.* 2564

538.54 : 621.365.5 = 4 2601

Theory of the heating of ferromagnetic bodies by eddy currents and hysteresis. JOUGUET, M. *Onde Élect.*, **27**, 138–51 (*April*, 1947) *In French.*—[Abstr. 2271 B (1947)].

538.566.3 : 551.510.535 : 621.396.11 2602

On the sporadic F_2-layer of the ionosphere. ALPERT, J. L. *C.R. Acad. Sci. URSS*, **55** (*No.* 1) 25–6 (1947).—The triple and quadruple echoes observed in ionospheric study are ascribed to double refraction occurring both in the F_2-layer proper and in the semi-transparent sporadic layer formed of ionized clouds. The method of investigation used enables the polarization of the reflected signals to be analysed and thus the ordinary to be distinguished from extraordinary signals. V. C. A. F.

MAGNETIC EFFECTS 538.6

538.612 : 537.228.3 : 535.515 *see Abstr.* 2527

538.615 : 535.331 *see Abstr.* 2488

538.615 : 535.338.3 = 4 *see Abstr.* 2491

538.615 : 535.43 : 535.372 *see Abstr.* 2511

538.615 : 539.156 : 535.33 *see Abstr.* 2482–3

ATOMIC AND MOLECULAR STRUCTURE 539

539.11 : 548.7 : 535.375.5 : 535.343.2–15 = 4 2603

Study of the vibrations of quartz active in Raman and infra-red absorption spectra. BARRIOL, J. *J. Phys. Radium* (*Sér.* 8) **7**, 209–16 (*July*, 1946) *In French.*—The modes of vibration of quartz are considered in the light of group theory. The frequencies are calculated on simple dynamical hypotheses and discussed in relation to published results on Raman and infra-red absorption spectra. A tentative calculation of elastic constants is given. L. A. W.

539.13 2604

Structure of the quadrielectron. ORE, A. *Phys. Rev.*, **71**, 913–14 (*June* 15, 1947).—A more accurate calculation of the binding energy of a system of two electrons and two positrons [see Abstr. 1586 (1947)] is made using a method similar to that of Weinbaum for molecular hydrogen. The binding energy obtained is 0·135 eV and the large mean distance apart of the particles shows that the quadrielectron has a high probability of dissociation when passing through matter. W. E. D.

539.13 : 539.155.2 : 535.375.5 : 535.343.3 *see Abstr.* 2501

539.132 : 535.338 = 4 *see Abstr.* 2490

539.132 : 541.61 = 4 2605

The study of molecules by the method of mesomerism. I–III. DAUDEL, R., AND PULLMAN, A. *J. Phys. Radium* (*Sér.* 8) **7**, 59–64 (*Feb.*); 74–83 (*March*); 105–11 (*April*, 1946) *In French.*—In I, the Slater–Pauling method is used for the calculation of the resonance energies of aromatic molecules and to indicate the relative importance of the different formulae proposed for them. In II, the choice of formula associated with each molecule, and the classification and number of these formulae are considered. In III, the method is improved and applied to the calculation of distribution of electronic charge, to molecular diagrams, to the utilization of the latter for the interpretation and prediction of chemical properties in the molecule, and to the excited state and polarization of molecules. H. H. HO.

539.133 2606

The bond energy, bond length and dissociation energy data for cyanogen and their relation to the heats of atomisation of carbon and nitrogen. SPRINGALL, H. D. *Trans. Faraday Soc.*, **43**, 177–84 (*April*, 1947).—The 4 possible values of the heat of formation of cyanogen gas from free atoms have been derived from the 2 possible values for the heats of atomization of graphite (126·2 or 171·6 kcal/atom) and of N gas (85·5 or 112·9 kcal/atom). Only that value dependent on taking the latter values agrees with that obtained from the experimental data on the energies involved in the stepwise dissociation of C_2N_2 to free atoms. The experimental values are shown to be reasonable in terms of valency theory on this basis, but not on any of the other 3 combinations. A.

539.133 2607

Average square length and radius of unbranched long-chain molecules with restricted internal rotation. TAYLOR, W. J. *J. Chem. Phys.*, **15**, 412–13 (*June*, 1947).—Formulae are reported for the case in which the rotation about each bond is restricted by the same potential function. It is assumed that there are no interactions between different rotations, but there are no restrictions on the form of the function, or on the extent of the rotation. The derivation and the general solution will be presented in a subsequent paper. A.

539.133 : 536.7 2608

Comparative thermodynamic properties of the restricted rotator and the harmonic oscillator. HALFORD, J. O. *J. Chem. Phys.*, **15**, 364–7 (*June*, 1947).—The differences between the thermodynamic properties of the restricted internal rotator and a defined harmonic oscillator are expressed within narrow limits as a function of the single variable V/RT, where V is the height of the restricting potential barrier. As a result, a single table with one column for each of the four thermodynamic functions can be used in conjunction with standard harmonic oscillator tables to give the restricted rotator properties. This approximation is accurate within 0·02 cal/mole/deg for nearly all cases to which it might be applied, and it is shown to be improbable that rotators will be found for which the error would rise appreciably above this limit. The harmonic oscillator chosen for comparison has a slightly lower frequency than the limiting one approached by the restricted rotator at very high values of V/RT. A.

539.133 : 539.152.2 *see Abstr.* 2615

539.133 : 541.57 2609

The non-degenerate vibrations of dimethylacetylene, diacetylene, and dimethyldiacetylene. MEISTER, A. G., AND CLEVELAND, F. F. *J. Chem. Phys.*, **15**, 349–57 (*June*, 1947).—By using force constants obtained fro the observed non-degenerate frequencies of dimeth acetylene and diacetylene, the non-degenerate frequenci of dimethyldiacetylene were calculated. It was found th when several of these force constants were modifie agreement to within 2% of the observed values of t frequencies was possible. In order to check the valu of the modified force constants the non-degenerate fr quencies of diacetylene were recalculated. The centr C–C stretching force constant was found to have a val of $3{\cdot}234_2 \times 10^5$ dynes/cm which ≪ the normal val $(5 \times 10^5$ dynes/cm). Finally, the previous tentati assignment of the observed Raman frequencies dimethyldiacetylene has been revised as a result of t calculations.

539.152.1 26

Higher angular momenta and long range interaction resonance reactions. WIGNER, E. P., AND EISENBUD, *Phys. Rev.*, **72**, 29–41 (*July* 1, 1947).—The results of tw preceding articles [Abstr. 2930 (1946), 937 (1947)] the energy dependence of the reaction and scattering cros sections are generalized. As before, the configuratio space is divided into two parts. In the internal regio or reaction zone there is no restriction on the type interaction between the particles. In the extern region, on the other hand, the interaction takes pla between the colliding or separating particles witho changing their structure (wave function). The prese article deals with a more general situation than t preceding ones, first by allowing for an interactio although only of a restricted type, outside the reactio zone. The most common type is the electrostatic inte action of the particles. In addition, the present artic does not restrict the angular momentum of the particl to zero, but permits the treatment of arbitrary angul momenta. The cross-sections are expressed in tern of the collision matrix U which is independent of t size of the internal region. U, in its turn, is expresse by the R matrix and the quantities describing the inte action in the external region. None of the quantitie except U, are strictly independent of the size of t internal region.

539.152.1 : 539.155.2 261

Isotopes of greatest abundance. LEVITSKAYA, M. *C.R. Acad. Sci. URSS*, **55** (*No.* 5) 395–8 (1947).—T composition of the most abundant isotope of eac element is given in terms of α-particles and neutrons basic units. In this scheme discontinuities (in particul in the number of surplus neutrons) occur at or ne $Z = 4, 18, 32, 48, 62, 76, 92$. These jumps are attribute to rearrangements in the nuclear α-particle lattice. It suggested that the isotopic number characterizes t agent which binds the α-particles in the nucleus. A. P.

539.152.1 : 539.17 *see Abstr.* 2644

539.152.2 261

Erratum: Quadrupole moments and spins of Br, and N nuclei. TOWNES, C. H., HOLDEN, A. N., BARDEE J., AND MERRITT, F. R. *Phys. Rev.*, **71**, 829 (*June* 1947).—See Abstr. 2206 (1947).

539.152.2 : 535.338.332 261

Hyperfine structure and the nuclear spin of U^{23}. ANDERSON, O. E., AND WHITE, H. E. *Phys. Rev.*, **7** 911 (*June* 15, 1947).—A value $I = 5/2$ is deduced for t nuclear spin number from arc spectrum measurements. W. E. I

539.152.2 : 535.338.332 261

The hyperfine structure of atomic hydrogen an deuterium. NAFE, J. E., NELSON, E. B., AND RABI, I. *Phys. Rev.*, **71**, 914–15 (*June* 15, 1947).—The hyperfi

cture separations ν_H and ν_D were measured for nic H and D by the atomic beam resonance method, are ~0·26% > the theoretical values (probable only 0·05%). The question is raised whether the ry requires modification, or whether the probable r of one or more of the fundamental constants in- ed therein is greater than at present assumed. There ven a small discrepancy between theory and experi- it in the ratio ν_H/ν_D. W. E. D.

.152.2 : 535.343 *see Abstr.* 2496

.152.2 : 539.133 2615

lectrostatic field strengths in molecules and nuclear drupole moments. TOWNES, C. H. *Phys. Rev.*, **71**, -10 (*June* 15, 1947).—An attempt is made, using nic analogues, to calculate the value of $\partial^2 V/\partial z^2$ at the leus in the case of the BrCN and ClCN molecules, nable the quadrupole moments of Br and Cl to be uated from a knowledge of the coupling between lear quadrupole moments and electric fields as asured by microwave spectroscopy. The results are sistent with rough estimates from atomic spectra. W. E. D.

.152.2 : 539.185 2616

The magnetic moments of the neutron and the deuteron. NOLD, W. R., AND ROBERTS, A. *Phys. Rev.*, **71**, 878–86 ne 15, 1947).—Radio-frequency resonance technique bstr. 1278 (1940)] was used to determine the Larmor quency of neutron precession in a magnetic field in ich the frequency of proton precession had been ermined [Abstr. 1351 (1946)]. The neutron/proton io is 0·68479 ± 0·0004. The deuteron/proton ratio 0·30702 ± 0·0001, in agreement with the Columbia ue. Taking the magnetic moment of the proton as 7896 nuclear magnetons, the neutron moment is 1·9103 ± 0·0012 and the deuteron moment 0·85647 ± 0003 nuclear magneton. These values lead to a pre- ction of an admixture of 4·0% $^3D_1$ state in the ground te of the deuteron, in agreement with the value 3·9% und [Abstr. 1076 (1941)] from the magnitude of the ctric quadrupole moment of the deuteron. The need r further theoretical investigation of the deuteron agnetic moment is pointed out. A.

9.153 2617

On the energy levels of a model of the compressed drogen atom. DE GROOT, S. R., AND TEN SELDAM, C. A. *ysica, 's Grav.*, **12**, 669–82 (*Dec.*, 1946).—The properties the zeros of the confluent hypergeometric functions e used to find the shift in the 1*s*, 2*s* and 2*p* levels as a nction of r_0, for an atom enclosed in a potential box radius $r = r_0$. G. J. K.

9.154.2 2618

The trans-uranium elements. SEABORG, G. T., AND GRÈ, E. *Nature, Lond.*, **159**, 863–5 (*June* 28, 1947).— short account of the formation, discovery and identifica- on of Pu, Np, Am and Cm with bibliography of 19 items.

9.155.2 2619

Upper limit to the tritium content of ordinary water. DINOFF, M. L. *J. Chem. Phys.*, **15**, 416 (*June*, 1947).— o increase of counting rate was observed when a ounter was filled with 95% enriched deuterium gas. his result, combined with calculations of the electrolytic paration factor of D and T and the 31-yr ½-life of T, ows that the T content of ordinary water <1 in 10^{17}.

9.155.2 : 533.15 2620

Thermal diffusion with boron trifluoride. WATSON, W., BUCHANAN, J. O., AND ELDER, F. K., JR. *Phys. ev.*, **71**, 887–90 (*June* 15, 1947).—With BF_3 gas at tmospheric pressure in 7 m of hot-wire Clusius and Dickel columns, with $\Delta T = 400°C$, the equilibrium separation factor for $B^{10}F_3/B^{11}F_3$ was 1·32 ± 0·12, reached in slightly over 3 days. The best separation factor per m of column indicates a thermal diffusion constant $\alpha \simeq +5{\cdot}0\times10^{-4}$ and $R_T \simeq 0{\cdot}06$. Experience in purifying commercial BF_3 gas and with mass spectrometer analyses is discussed. A.

539.155.2 : 535.375.5 : 539.13 : 535.343.3 *see Abstr.* 2501

539.155.2 : 536.48 2621

Concentration of He^3 in the liquid and vapor phases of He^4. FAIRBANK, H. A., LANE, C. T., ALDRICH, L. T., AND NIER, A. O. *Phys. Rev.*, **71**, 911–13 (*June* 15, 1947).— The ratio of the He^3/He^4 concentration in the vapour to the corresponding concentration in the liquid state was found to fall from about 6 at 2·2°K to unity at 5·2°K. A curve is given. W. E. D.

539.155.2 : 536.7 : 541.121 2622

The thermodynamic properties of isotopic substances. UREY, H. C. *J. Chem. Soc.*, 562–81 (*April*, 1947).— A limited amount of work on protium and deuterium is reviewed in relation to similar work on the isotopic compounds of other elements, where the effects observed are much smaller. Also the paper is limited to equilibrium properties and does not include work dealing with differences related to the kinetics of chemical reactions. The theory of the equilibrium constants of exchange reactions is dealt with at length, and 14 tables of numerical results and of known data are included, from which calculations are made. The ratios of the vapour pressures of isotopic compounds are discussed, and the geological abundances of the C and O isotopes, and the relative abundances of the O isotopes in air and water are reviewed. A table gives some calculated max. variations in atomic weights, and methods for the separation of isotopes are mentioned. As a result of the theoretical and experimental studies reviewed, it has been established that isotopes and isotopic compounds differ in their thermodynamic properties. H. H. HO.

539.155.2 : 539.152.1 *see Abstr.* 2611

539.156 : 538.615 : 535.33 *see Abstr.* 2482–3

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16/.18 : 542.921.9 2623

Radiation chemistry. BURTON, M. *J. Phys. Coll. Chem.*, **51**, 611–25 (*March*, 1947).—Contains an account of experiments on the chemical effects of high energy radiations (deuterons, neutrons, X-rays, electrons and radiations from radioactive fission products) made in connection with atomic energy projects in the U.S.A. A new "discomposition" effect in solids is reported, as well as typical results on solids, water and organic compounds. They are interpreted in the light of the Franck–Condon principle, Franck's principle of increased probability of internal conversion with increase in molecular complexity, and the principle that the ionic configuration is more nearly like that of the uncharged molecule the greater the size of that molecule. In general, the interpretations are consistent with those made by recent English workers for radiations with rather lower energies. C. B. A.

539.16/.18 : 542.921.9 2624

Effects of high-energy radiation on organic compounds. BURTON, M. *J. Phys. Coll. Chem.*, **51**, 786–97 (*May*, 1947).—A review, including work done both inside and outside atomic energy projects. All the processes which occur in photochemical reactions occur in radio-chemical

processes, but in the latter case there are also the peculiar reactions originating in ionization or the discharge. Any electron in a molecule is equally susceptible to ionization in the initial act. The yield of a particular product is closely related to the number of parent groups in the molecule. A number of particular cases is discussed. [See also Abstr. 2623 (1947)]. C. B. A.

539.16.08 : 621.318.572 = 3 2625

Electron-tube spectrograph for the measurement of ionization chamber pulses. MAEDER, D. *Helv. Phys. Acta*, **20** (*No.* 2) 139–52 (1947) *In German.*—[Abstr. 2248 B (1947)].

539.16.08 : 621.318.572 : 621.317.761 2626

Frequency meter for random or uniformly spaced pulses. SCHULTZ, H. L. *Rev. Sci. Instrum.*, **18**, 223–5 (*April*, 1947).—[Abstr. 1979 B (1947)].

539.16.08 : 771.534.554 = 5 *see Abstr.* 2746

539.163 2627

Decay of K^{40}. MEYER, H. A., SCHWACHHEIM, G., AND DE SOUZA SANTOS, M. D. *Phys. Rev.*, **71**, 908 (*June* 15, 1947).—Coincidence measurements showed that Ca^{40} is not left in an excited state, thus agreeing with the disintegration scheme of Hirzel and Wäffler [*Helv. Phys. Acta*, **19**, 216 (1946)]. W. E. D.

539.163 = 4 2628

The radiations and excitation levels of some radioactive bodies. SURUGUE, J. *J. Phys. Radium* (*Sér.* 8) **7**, 145–50 (*May*, 1946) *In French.*—From data available in the literature, a comprehensive level scheme has been drawn up for each of the three natural radioactive series, showing the energies and intensities of the α-, β- and γ-radiations leading from the *B*-bodies (active deposits) to Pb. Energy levels are referred to Pb as zero. A. P. F.

539.163.1 = 3 2629

β-disintegration of N^{16}. BLEULER, E., SCHERRER, P., WALTER, M., AND ZÜNTI, W. *Helv. Phys. Acta*, **20** (*No.* 1) 96–104 (1947) *In German.*—The disintegration has been studied by means of the Wilson chamber and by absorption determinations. The $\frac{1}{2}$-life is $7{\cdot}35 \pm 0{\cdot}05$ sec. The β-spectrum is complex with components of max. energy 10·3, 6·2 and 6·7 MeV, with the possibility of a further component at ~ 5 MeV. The mass of N^{16} is calculated to be $16{\cdot}0111 \pm 0{\cdot}0008$. A. J. M.

539.163.1 = 3 2630

Metastable states of the silver nuclei Ag^{107} and Ag^{109}. BRADT, H., GUGELOT, P. C., HUBER, O., MEDICUS, H., PREISWERK, P., SCHERRER, P., AND STEFFEN, R. *Helv. Phys. Acta*, **20** (*No.* 2) 153–65 (1947) *In German.*—The two isomeric Ag nuclei, Ag^{*107} and Ag^{*109}, the breakdown products of 6·7-hr Cd^{107} and 330-day Cd^{109}, respectively, have been investigated. Conversion probabilities of the 93·9 keV γ-radiation of the 44·3-sec Ag_I^* and the 89·0 keV γ-radiation of the 39·2-sec Ag_{II}^* are not very different. The relative intensities of *K*, *L*, and *M* conversion lines are obtained. A. J. M.

539.163.1 : 539.185.7 2631

Evidence for, and cross section of 115 day Se^{75}. FRIEDLANDER, H. N., SEREN, L., AND TURKEL, S. H. *Phys. Rev.*, **72**, 23–5 (*July* 1, 1947).—Evidence has been given to show that the 115-day activity produced in Se by thermal neutrons is due to Se^{75} which decays by *K*-capture to As^{75}, accompanied by a 0·4 MeV γ-ray. A value for the cross-section of Se^{74} for radiative capture of a thermal neutron has been given. A.

539.163.1 : 539.185.7 *see Abstr.* 2656

539.163.2 2632

Disintegration of scandium^{46}. FEISTER, I., AND CURTISS, L. F. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 411–14 (*April*, 1947).—The β and γ radiations of Sc^{46} have been studi by means of a magnetic-lens spectrometer. The β-r spectrum was found to be simple, with max. energy 0·36 MeV, and no indications of any other β rays wi energies above this value. The γ-ray spectrum consi of 2 γ-rays with energies 0·88 MeV and 1·12 Me These two lines appear to be of equal intensity, and a therefore very probably in cascade.

539.163.2 26

Radiations from As^{72}. MITCHELL, A. C. G., JURNE E. T., AND RAMSEY, M. *Phys. Rev.*, **71**, 825 (*June* 1947).—The upper limit of the positron energy was fix at $2{\cdot}78 \pm 0{\cdot}10$ MeV by absorption measurements in A measurement on the Compton recoil electrons gave a energy of 2·4 MeV for the accompanying γ-radiatio Coincidence experiments indicate the existence of mo than one group of positrons. W. E.

539.163.2 26

On the alleged gamma-ray of N^{13}. LANGER, L. M COOK, C. S., AND SAMPSON, M. B. *Phys. Rev.*, **71**, 9 (*June* 15, 1947).—If γ-rays are emitted, their frequen per disintegration in the energy region 0·135–0·700 Me is $<0{\cdot}002$ at the low end, rising to $<0{\cdot}06$ at the hig the evidence is also against any appreciable intensity higher energies. W. E. I

539.163.2 = 4 263

A contribution to the study of the nuclear isomerism Cd and Hg. HOLE, N. *Ark. Mat. Astr. Fys.*, **34** (*Paper* 19) 8 *pp.* (1947) *In French.*—Using a β-ray spectr graph, the spectra of the internal conversion electron from Cd* and of the photo-electrons liberated by i γ-radiation from Pb were analysed. The emission of tw quanta in succession (145 keV and 230 keV, or vice versa was deduced. A similar study for Hg* revealed cor version electrons but no photo-electrons. It was inferre that two totally converted quanta, of 222 keV an 362 keV, are emitted. A. P. I

539.164.2 263

The theory of alpha-radioactivity. PRESTON, M. A *Phys. Rev.*, **71**, 865–77 (*June* 15, 1947).—A number o authors have developed the theory in the case of zer angular momentum of the escaping particle. For $l \neq 0$ formulae have also been given, but it is shown that thes are inaccurate. In order to discuss the case of non-zer values of l, the one-body theory with a rectangula potential well is treated rigorously, giving two equation linking the radius of the nucleus and the depth of it potential hole with the decay constant and the energy o the emitted α-particles. The usefulness and reliability fo this problem of the one-body model are examined A re-evaluation of nuclear radii has been performed an the results are tabulated. The possibility that the decay constant, for fixed energy, is not a monotonic functio of l but has an initial rise is discussed. A quantitativ study is made of the $\lambda - E_\alpha$ relationships in a few α-ra spectra with "fine structure." A

539.164.92 : 537.311 263

Conductivity pulses induced in diamond by α-particles WOOLDRIDGE, D. E., AHEARN, A. J., AND BURTON, J. A *Phys. Rev.*, **71**, 913 (*June* 15, 1947).—The number o ions produced in diamond by α-particles $\simeq$ the numbe produced in air. Two systems were used: one, with a potential difference of 5 V between electrodes 0·003 cm apart on a surface of the diamond, and the other, with 100 V between electrodes on opposite faces of a diamon 0·5 mm thick. W. E. D.

539.164.93 : 778.34 263

Fading of latent α-ray image in emulsions. YAGODA, H., AND KAPLAN, N. *Phys. Rev.*, **71**, 910–11 (*June* 15,

).—Delay in developing plates after exposure to ·ticles reveals that in emulsions of low Ag content ·rack has completely disappeared if development is ·ed beyond 5 days, whereas with improved plates the ·s, though fainter, are still visible after 20 days.
W. E. D.

165.8 2639
ectrical method of separation of nuclear isomers. SSINOW, L. I., AND KARAMIAN, A. S. *C.R. Acad. URSS*, **55** (*No.* 7) 599–600 (1947).—When 4·2-hr. · formed by slow neutron irradiation of C_2H_5Br, ys by internal conversion to an 18-min. ground state ·er, the latter is found attached to an ionized mole- and can be removed by an electric field. A. P. F.

165.8 2640
ecoil of silver nuclei due to *K*-capture in cadmium. GHT, B. T. *Phys. Rev.*, **71**, 839–41 (*June* 15, 1947).— e evidence has been obtained for the existence of the ·rino by observing recoils following *K*-capture in Cd. experiment is inconclusive because the recoiling Ag ns were uncharged, and thus the recoil energy could be compared with the expected value. A.

167.3 2641
-ray excitation of lutecium. DUNWORTH, J. V., AND ·TECORVO, B. *Proc. Camb. Phil. Soc.*, **43**, 429–32 ·y, 1947).—This gives a β-emitting activity (as inct from electron conversion activity) of period ± 0·1 hr and of ½-value absorption thickness in ~ 70 mg/cm². This is almost certainly the same vity as that observed from slow-neutron bombard- ·nt of Lu and allocated previously to Lu^{176} [Abstr. 547 46)]. The isomeric state of Lu^{176} is responsible for the ivity has a very high excitation energy (~ 0·5 MeV or re). The evidence is inconclusive on the allocation of 6·6-day activity which is obtained by slow neutron ·mbardment. A.

).167.3 : 537.591 : 550.423 2642
Radiocarbon from cosmic radiation. ANDERSON, E. C., ·BY, W. F., WEINHOUSE, S., REID, A. F., KIRSHENBAUM, D., AND GROSSE, A. V. *Science*, **105**, 576–7 (*May* 30, 47).—[See Abstr. 2663 (1946)]. Two series of iso- ·ically enriched samples of CH_4 were examined for ·dioactivity. The first, derived from mineral petroleum, ·d therefore isolated from atmospheric CO_2 for periods ½-life of C^{14}, showed no activity. The second, derived ·m city sewage ("biological carbon") showed an ·tivity proportional to calculated C^{14} concentration. ·e identification was confirmed by (*a*) burning the CH_4 d converting to $CaCO_3$, thus eliminating the possibility H^3; (*b*) measuring the absorption of the radiation in . The activity in normal "biological" C amounts to ·5 disintegrations/min/g.

9.17 2643
The technique of bombarding organic compounds with ·uterons. HONIG, R. E. *Rev. Sci. Instrum.*, **18**, 389–94 *une*, 1947).—Gas bombardments were made at approxi- ·ately atmospheric pressure in a water-cooled gas ·amber (volume, 2·54 l) provided with a 0·002 in Cu ·indow for the entry of the beam. A thermocouple and Bourdon gauge connected to a Microtorque potentio- ·eter allowed the gas temperature and pressure to be ·corded electrically during the bombardment of liquids ·nd solids. Water-cooled target-holders provided with ·u windows were mounted inside the gas chamber ·hich served to collect the product gases. To prevent hemical reactions of the compounds with the metal parts, hamber and target-holders were gold-plated. A.

539.17 : 539.152.1 2644
On the division of nuclear charge in fission. PRESENT, R. D. *Phys. Rev.*, **72**, 7–15 (*July* 1, 1947).—The theory of the most probable charge number of a fission fragment of given mass number is examined. Two hypotheses previously suggested are: (1) that the charges divide in the same ratio as the masses, and (2) that the most probable charges correspond to minimum energy of two droplets in contact. These hypotheses predict results at variance with each other and with preliminary experiments. In this paper, the actual division of charge is calculated for the final configuration of spheres in contact, on the basis of a general nuclear model in which the charge distribution in the nucleus is non-uniform. The tendency of the protons to spread outward results in the smaller fragment of an asymmetric fission having a greater proton-neutron ratio than the larger fragment. In the most probable division (mass ratio 2 : 3) the most probable partners (of odd mass number) should both have β-decay chain lengths equal to 3·6. In the case of a 1 : 2 mass ratio, the probable chain lengths of the light and heavy partners should be 2·5 and 4·1, respectively. Data on the independent fractional yields of particular chain members are found to lie near a smooth (error) curve when plotted with the aid of the theoretical results. A.

539.172 2645
Observation of a new type of reaction (He^3, He^4). LUKIRSKY, P. I., MESCHERYAKOV, M. G., AND KHRENINA, T. I. *C.R. Acad. Sci. URSS*, **55** (*No.* 2) 117–20 (1947).—The occurrence of the reaction is deduced from two abnormal tracks found in photographic plates bombarded with He^3 ions of 5·7 MeV. The reaction is exothermic by several MeV. The struck nucleus makes no visible recoil track and is thought to be Ag or Br. An Oppenheimer–Phillips type of mechanism is suggested for the process. A. P. F.

539.172 2646
Chemical forms assumed by C^{14} produced by neutron irradiation of beryllium nitride. YANKWICH, P. E. *J. Chem. Phys.*, **15**, 374–5 (*June*, 1947).—Solution of the irradiated powder gave activities corresponding to methane, carbon monoxide, carbon dioxide, hydrogen cyanide, methanol, and formic acid. Formaldehyde was not found. The distribution of activities is not affected by the acidity of the solvent. The results are considered in the light of earlier work. A.

539.172.13 2647
Width of 985 KeV Al (p, γ) resonance. BENDER, R. S., SHOEMAKER, F. C., AND POWELL, J. L. *Phys. Rev.*, **71**, 905 (*June* 15, 1947).—Using a cylindrical electrostatic analyser to regulate the energy of the bombarding proton beam, the width at ½ max. intensity of this resonance level was found to be 300 ± 50 eV. W. E. D.

539.172.13 2648
Protons from the deuteron bombardment of separated neon isotopes. ELDER, F. K., JR., MOTZ, H. T., AND DAVISON, P. W. *Phys. Rev.*, **71**, 917–18 (*June* 15, 1947). —By measurements on two samples, one almost pure Ne^{20} and the other a mixture of Ne^{20} and Ne^{22} in approximately equal amounts, it has been possible to determine from which isotope the various protons from the (d, p) reaction originate. Recent values of the masses of $Ne^{20, 21, 22, 23}$ and of Na^{23} are listed. W. E. D.

539.18 2649
On the production of mesotrons by nuclear bombardment. MCMILLAN, W. G., AND TELLER, E. *Phys. Rev.*, **72**, 1–6 (*July* 1, 1947).—Mesotron production by nuclear bombardment with fast, heavy particles has been in-

vestigated theoretically in a semi-quantitative way to determine the expected threshold energies, the cross-sections, and their energy dependence. Whereas a treatment in which the target nucleons are assumed to be at rest predicts a requisite incident energy of ~210 MeV, the present treatment, based on the Fermi degenerate gas model, finds the threshold incident energy as ~95 MeV. The threshold is somewhat higher for pos. than for neg. mesotrons. The cross-section for single mesotron production, evaluated from the accessible volume in momentum space, is found to vary with the fractional excess energy, ε, as $\varepsilon^{3\cdot5}$ in the scalar or axial-vector theories; at low values of ε, a small difference in the energy dependence for neg. and pos. mesotrons arises from the necessity of giving the former a non-zero initial kinetic energy. For the pseudo-scalar and the polar-vector theories, the matrix element for mesotron emission is proportional to the momentum of the mesotron. This changes the power law to $\varepsilon^{4\cdot5}$. A.

539.18 2650

Cross-sections for production of artificial mesons. MORETTE, C., AND PENG, H. W. *Nature, Lond.*, **160**, 59–60 (*July* 12, 1947).—Approx. calculations based on the theory of radiation damping are reported for the processes: (*a*) nucleon + nucleon = meson + nucleon + nucleon. (*b*) γ-ray + nucleon = meson + nucleon. The mesons (mass μ) are produced by reaction (*a*) with uniform angular distribution and energies from zero to $\varepsilon_{max} = \frac{1}{2}E - \mu c^2$ (but mainly with $\varepsilon > \frac{1}{2}\varepsilon_{max}$) when the energy E of the incident nucleon $> 2\mu c^2$; cross-sections are tabulated. The ratio of cross-section for electron pair production to that under reaction (*b*) is ~ 200 in Pb and 30 in air at $h\nu \simeq 2\times10^8$ eV, and ~ 70 in Pb and 10 in air at $h\nu \simeq 5\times10^8$ eV.

539.185 2651

Isotopic changes in cadmium by neutron absorption. DEMPSTER, A. J. *Phys. Rev.*, **71**, 829 (*June* 1, 1947).—It is shown that Cd^{113} is the isotope chiefly responsible for neutron absorption, all the other chief isotopes having absorption cross-sections <1/40 that of Cd^{113}. W. E. D.

539.185 2652

Some stationary distributions of neutrons in an infinite medium. VERDE, M., AND WICK, G. C. *Phys. Rev.*, **71**, 852–64 (*June* 15, 1947).—Some stationary solutions of the transport equation describing the diffusion and slowing down of neutrons in an infinite homogeneous medium are presented for the following cases: constant mean free path, power spectrum in energy and exponential behaviour in space; constant m.f.p., point source of fast neutrons; variable m.f.p. proportional to a power of velocity, point source of fast neutrons. For this last case the possibility of actual numerical computation of the neutrons distribution is displayed on one example, approximately describing conditions in water or paraffin. A.

539.185 2653

Phase of scattering of thermal neutrons by aluminium and strontium. FERMI, E., AND MARSHALL, L. *Phys. Rev.*, **71**, 915 (*June* 15, 1947).—Scattering intensities from the crystals Al_2O_3 and $SrSO_4$ are listed, but cannot be fitted to actual values of the scattering length for Al and Sr. It is deduced that the sign of the scattering is the same for Al and O. W. E. D.

539.185 : 539.152.2 *see Abstr.* 2616

539.185.7 2654

Method for measuring neutron-absorption cross sections by the effect on the reactivity of a chain-reacting pile. ANDERSON, H. L., FERMI, E., WATTENBERG, A., WEIL, G. L., AND ZINN, W. H.. *Phys. Rev.*, **72**, 16–23 (*July* 1, 1947). Introduction of a neutron-absorbing substance into a p decreases the reactivity and in order to keep the pov level constant the control rods must be displaced. proper calibration this displacement may be used as precision measure of the absorption cross-section.

539.185.7 26

The Milne problem for a large plane slab with const source and anisotropic scattering. MARSHAK, R. *Phys. Rev.*, **72**, 47–50 (*July* 1, 1947).—Formulae a derived for the asymptotic neutron density and t neutron current emerging from an ∞ plane slab whc thickness is ≫ scattering mean free path. It is suppos that the slab sustains a uniform source of neutrons. T neutrons suffer capture in addition to scattering. T scattering is assumed to take place in accordance with t law: $(1/4\pi)(1 + 3f_1\mu)$ where f_1 = const., and μ = c (angle of scattering). Expressions for the asympto neutron density in the slab and the emerging curre in the limiting case of isotropic scattering, are given.

539.185.7 : 530.14 *see Abstr.* 2405

539.185.7 : 539.163.1 26

Preliminary determination of the neutron absorpti cross-section of long-lived I^{129}. KATCOFF, S. *Phys. Re* **71**, 826 (*June* 1, 1947).—I^{129} production by fission in pile was irradiated with slow neutrons. The 12 hr. I^{130} was then found to be present, and assumi this to be produced from the I^{129}, a rough estimate $2\cdot5\times10^{-24}$ cm² is derived for the cross-section of t process. A ½-life for I^{129} of 10^8 years or longer estimated; and an upper limit of 3 parts in 10^6 for t abundance of I^{129} in normal I, by comparison of sim taneously irradiated samples of the latter. W. E.

539.185.7 : 539.163.1 *see Abstr.* 2631

539.185.7 : 778.34 = 3 26

Neutron photography. PETER, O. *Z. Naturforsch.*, 557–9 (*Oct.*, 1946) *In German.*—By placing an object front of an Ag foil and irradiating it with slow neutro from a localized source, a shadow picture in terms β-radioactivity was obtained. The Ag foil was th placed on a photographic plate to secure a permane record. The results resemble X-ray photographs of t same objects, but show specific differences—e.g. stro shadows of hydrogenous materials. A. P.

539.185.9 : 550.839 *see Abstr.* 2714

STRUCTURE OF SOLIDS 539.2

539.215 : 539.389.3 26

Recovery and recrystallization viewed as processes dissolution and movement of dislocations. I. BURGE W. G. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 5) 452 (1947).—Part I of a general review. Recovery a recrystallization depend on temp. and time in much t same way, which suggests that recovery is recrystalliz tion on a scale too small to be observed. On the oth hand, recovery is never complete, and the state aft recovery depends on the degree of cold-working, whi suggests that there is a fundamental difference betwe the mechanisms of recovery and recrystallizatio Recovered states are of considerable stability, a are intermediate between the cold-worked and the full annealed state. A. J. C.

539.215 : 539.389.3 26

Recovery and recrystallization viewed as processes dissolution and movement of dislocations. II. Bloc structure of the crystalline state. BURGERS, W. G. *Pro K. Ned. Akad. Wet.*, **50** (*No.* 6) 595–606 (1947).—Re

tals possess a mosaic structure, blocks of 10^{-4} to ^{5} cm in linear dimension being perfect, but adjoining ks differing in orientation by a few seconds or utes of arc. The boundaries of the blocks involve a ılar series of Taylor dislocations. In cold-worked tals there are dislocations throughout the blocks as as at the boundaries; the energy stored in a cold-ked metal suggests that there are $\sim 10^{12}$ dislocation s per cm². The stability of 2-dimensional systems of ocations is discussed. A. J. C. W.

.215.2 : 539.32 : 539.389.3 *see Abstr.* 2667

.217 : 537.311.33 = 3 2660

)bservations on the diffusion of thallium in crystalline agonal selenium. GUDDEN, B., AND LEHOVEC, K. *Naturforsch.*, **1**, 508–12 (*Sept.*, 1946) *In German.*—:vaporated on to the end of a rod of Se diffuses into vith a velocity of $\sim 0{\cdot}2$ cm/day at 216°C. The depth penetration $\propto$ time, not $\sqrt{}$(time) as required by the al diffusion law. Cu, Ag, Au, Mg, Zn, Cd, Al, In, , Sn, Te and Bi do not diffuse. The depth of penetra-n can be followed by spectroscopic analysis of speci-ns removed from the surface of the rod, or more ıveniently by measurement of the potential distri-ion along the rod when a difference of 100 V is intained between its ends. The resistivity of pure Se 2 kΩ cm at room temp., that of Tl-containing Se out 100 × higher, but that of the transition layer ere the Tl concentration is $\sim 10^{-6}$ is 2×10^{8} Ω cm, that 90% of the potential drop takes place at the undary. The diffusion can be aided or reversed by an ctric field; the ions appear to be Tl^{+++}. A. J. C. W.

).234 : 537.311.31 = 4 2661

Measurements on thin silver films. VAN ITTERBEEK, A., D DE GREVE, L. *Portugal. Phys.*, **2** (*No.* 2) 125–37)46) *In French.*—The apparatus and technique of position, by evaporation, on Pyrex plates of thin Ag ns arranged for electrical resistance measurement, are scribed. The velocity of crystallization, as a function film thickness (determined by weighing) and temp., is culated from resistance/time measurements, and the tivation energy shown to be $= k\Theta = 427$ cal/g atom Θ = Debye characteristic temp.). [See Abstr. 1169)44)]. A sudden change in resistance is produced by introduction of gas into the apparatus, pos. for O_2, , He, N_2, C_2H_4 and neg. for NH_3. S. W.

9.262 : 548.733 *see Abstr.* 2697

9.262 : 621.357.7 2662

A simple technique for the X-ray determination of er-axes in electro-deposited metals. WYLLIE, M. R. J. *v. Sci. Instrum.*, **18**, 425–9 (*June*, 1947).—A special mera, designed for the determination of orientation in ctro-deposited metals, is described. An account is also ven of a method of computing the numerical value of e fibre-axis of the orientated crystals from simple ear measurements on the films obtained. A.

ASTICITY . STRENGTH . RHEOLOGY 539.3/.8

9.32 2663

The elastic constants of materials loaded with non-rigid lers. DEWEY, J. M. *J. Appl. Phys.*, **18**, 578–81 (*June*, 47).—General expressions are given for the modulus rigidity and compressibility in terms of the values of imé's consts. for the materials and the volume fraction. ne case of a gas filler is included and expressions for splacements and stresses within the medium and the rticles, neglecting interactions between the particles, so given. A.

539.32 : 538.242 2664

Note on a variation with frequency of the torsional modulus of German silver wire and its relation to gyromagnetic measurements. BARNETT, S. J., AND WEBBER, D. S. *Phys. Rev.*, **71**, 896–902 (*June* 15, 1947).—Discrepancies between earlier investigations [Abstr. 2364 (1925), 148 (1941), 818 (1946)] prompted measurements of the variation of the modulus with frequency, over the ranges 17–50 c/s, and 4–28 sec periods. No change was observed in either of these ranges, but the modulus was 1% lower in the higher frequency range. This change is insufficient to account for the discrepancies. A.

539.32 : 539.215.2 : 539.389.3 *see Abstr.* 2667

539.32 : 539.501 : 550.31 = 5 *see Abstr.* 2707

539.32 : 669.355 : 548.7 *see Abstr.* 2692

539.37 2665

On the law of deformation of amorphous and polycrystalline bodies. GUREVICH, G. *C.R. Acad. Sci. URSS*, **55** (*No.* 6) 493–6 (1947).—The author shows that for several high polymers, and also for Al, Pb and Cu under certain conditions, the following equation holds: $\log(v/\sigma_{const.}) = A\sigma_{const.} - B$ where v = rate of strain, $\sigma_{const.}$ = yield stress. At high temperatures or with softer bodies the equation changes into one representing Newtonian flow. G. O. B.

539.374 2666

X-ray diffraction studies of yielding in mild steel. COWLEY, J. M., AND PATERSON, M. S. *Nature, Lond.*, **159**, 846 (*June* 21, 1947).—The region of "Lüders lines" in a slightly yielded bar was examined, using a narrow X-ray beam, blurring of spots being taken as indication of plastic deformation. This was found to be greatest at the actual position of a line, and, between the lines, greater near the middle of the region of lines than near the end. The conclusion is that as the region of strain-bands grows by the formation of new bands, the bands formed earlier grow laterally by an increase of plastic distortion on either side.

539.389.3 : 539.215 *see Abstr.* 2658–9

539.389.3 : 539.215.2 : 539.32 2667

Stress relaxation across grain boundaries in metals. KÊ, T.-S. *Phys. Rev.*, **72**, 41–6 (*July* 1, 1947).—The temp.-dependence of internal friction and rigidity modulus of 99·991% Al have been measured as a function of frequency of torsional vibration and of grain size. An increase of frequency of vibration shifts the internal friction curve and the rigidity relaxation curve (Q^{-1} and G/G_U *v.* temp.) to higher temps; and when the frequency of vibration is kept constant, a change in grain size of the specimen has the same effect as a change of the frequency of vibration. The observed internal friction and rigidity relaxation can be expressed as functions of the parameter $(G.S.)\times f\times\exp(H/RT)$, where (G.S.) is the grain size or average grain dia. of the specimen, f is the frequency of vibration, and H is the heat of activation. It is shown that all these observed phenomena are necessary manifestations of the stress relaxation across grain boundaries arising from the viscous behaviour of the grain boundaries in metals, which behaviour has been demonstrated by previous anelastic-effect measurements. A.

539.4.011 : 541.185.55 2668

New physico-chemical phenomena in the deformation and mechanical treatment of solids. REHBINDER, P. *Nature, Lond.*, **159**, 866–7 (*June* 28, 1947).—A brief account of investigations on the action of surface-active substances, adsorbed on the surface of micro-cracks, in

lowering the resistance of a solid to strain. Mica has been found to show an elastic after-effect when wetted with such substances. The yield value of Sn was halved by immersing in a fluid containing oleic acid or cetyl alcohol, and the number of slip planes increased 15 times.

539.415.2 : 621.93.01 2669

Direction of maximum crystal elongation during metal cutting. TOWNEND, G. H. *J. Appl. Phys.*, **18**, 489–90 (*May*, 1947).—[Abstr. 2368 B (1947)].

539.501 2670

Two-dimensional plastic flow of a Bingham solid. A plastic boundary-layer theory for slow motion. OLDROYD, J. G. *Proc. Camb. Phil. Soc.*, **43**, 383–95 (*July*, 1947).—The equations of motion as given and the derived equations for the stream function are much more difficult to solve than the corresponding equations obtained by putting $\theta = 0$ for a viscous fluid. The approximate plastic boundary layer equations are much easier to handle. Their conditions of applicability are discussed. Some of the results derived for infinite masses of material may be expected to hold with reasonable accuracy for finite amounts, since it has not been necessary to specify in great detail the outer boundary condition in the elastic region. The possibility of experimental tes thus arises. G. O. B

539.501 267

Rectilinear plastic flow of a Bingham solid. I. Flo between eccentric circular cylinders in relative motion OLDROYD, J. G. *Proc. Camb. Phil. Soc.*, **43**, 396–40 (*July*, 1947).—On the basis of the general equations o plastic flow between coaxial cylinders in relative motio an approximate velocity distribution is derived for the case of eccentric circular cylinders as rigid boundaries an zero pressure gradient. The approximation is valid onl if a dimensionless parameter S, proportional to the yiel value, is sufficiently small, and that there is flow in the whole region between the cylinders. The differences i velocity distribution in the cases of a Bingham solid an a Newtonian liquid are illustrated. It is shown that the effect of a finite yield value is to cause the contours o equal velocity in a normal section to become more nearl concentric with the inner boundary as the yield valu increases from zero. Confirmatory experimental dat are lacking. G. O. B

539.501 : 539.32 : 550.31 = 5 *see Abstr.* 2707

PHYSICAL CHEMISTRY 541

THERMO-CHEMISTRY 541.11

541.115 : 541.552 = 4 *see Abstr.* 2679

PHASE EQUILIBRIUM 541.121/.123

541.121 : 536.7 : 539.155.2 *see Abstr.* 2622

541.123 : 531.19 : 536.7 *see Abstr.* 2548

541.123.2 : 531.19 : 536.7 *see Abstr.* 2549

REACTION KINETICS 541.124/.128

541.124 = 4 2672

Onsager's principle of reciprocity and the coupling of chemical reactions. PRIGOGINE, I. *Bull. Acad. Belge, Cl. Sci.*, **32** (*Nos.* 1–3) 30–5 (1946) *In French.*—It is first shown that if Onsager's reciprocity principle is valid for a system of chemical reactions, it is so for all equivalent systems which may be formed by linear combinations from the initial system. This invariance of Onsager's principle is of profound physical significance. The conditions are then investigated for a system in which the coefficients of mutual velocity are not all zero, and, after a suitable transformation, it is shown that an equivalent system is formed of independent reactions. An example is taken of the case where the connection between the different reactions of the initial system is only apparent and disappears when the reactions considered are suitably combined. H. H. HO.

541.126 : 534.222.2 2673

Speed around the initiating point of the detonation wave in high explosives. SHEPHERD, W. C. F. *Nature, Lond.*, **160**, 92–3 (*July* 19, 1947).—Weibull's conclusions [Abstr. 1662 (1947)] are criticized. More accurate observations are reported, indicating pre-detonation phases lasting until the explosion had traversed up to $\frac{1}{3}$ of the cartridge. The dependence of detonation rate on the physical state of the explosive and the nature of the experimental conditions.

541.127 : 77.012 = 5 *see Abstr.* 2743

541.128 : 542.941.7/.8 *see Abstr.* 2683

541.128.1 : 536.242 *see Abstr.* 2542

COLLOIDS . DISPERSE SYSTEMS 541.18/.18

541.18.055 267

The density increments of proteins. ADAIR, G. S., AN ADAIR, M. E. *Proc. Roy. Soc. A*, **190**, 341–56 (*Aug.* 12 1947).

ADSORPTION 541.183

541.183.35 : 536.7 : 532.612.4 = 4 *see Abstr.* 2425

541.185.55 : 539.4.011 *see Abstr.* 2668

541.183.56 267

Adsorption of vapours on active charcoals in relation t the physical properties of the adsorbate. DUBININ, M. M. AND TIMOFEYEV, D. P. *C.R. Acad. Sci. URSS*, **55** (*No.* 2 137–40 (1947).—With Polanyi's multimolecular theory a basis, an equation is derived for the adsorption isotherm $a = (W_0/V)\exp\{-BT^2(\log p/p_s)^2/V^2\}$ where a = ad sorption at pressure p; p_s = saturated vapour pressur and V = molar volume of the liquid adsorbate; T = abs temp.; W_0 and B are constants characteristic of th adsorbent. It shows moderate agreement with experi ment for 10 organic vapours on a given charcoal. S. J. G

541.183.56 267

Multilayer gas adsorption on composite surfaces MCMILLAN, W. G. *J. Chem. Phys.*, **15**, 390–7 (*June* 1947).—The equation of Brunauer, Emmett, and Telle (BET) for the adsorption of a gas on a free plan homogeneous surface is extended to the case of a mixtur of two such surfaces, in an attempt to explain th observed deviations below one monolayer. The resultin equation is greatly simplified for the case that th adsorption energy parameter $\gg 1$ for each componen surface. This approximate form is applied to the N isotherm on an inorganic salt and gives substantiall better agreement with experiment than does the simpl BET equation. Conditions are given under which on might obtain two distinct regions of the isotherm whic are fitted by the BET equation by the use of two sets o parameters. It is suggested that it is the lower of thes two regions which gives rise to the occasionally observed "saturation adsorption" values corresponding to onl small fractions of a monolayer. A

3.56 : 533.275 2677

orption of water vapour in high-vacuum apparatus. SH, R. G. W., AND RUSSELL, K. E. *Nature, Lond.*, 57 (*July* 12, 1947).—This can be prevented (as ed, e.g. for the accurate measurement of water- r pressure) by providing the glass with a hydro- monolayer of "Cetavlon."

: 535.43–15 *see Abstr.* 2525

CHEMICAL STRUCTURE 541.4/.6

2 = 4 2678

oduction of the charge factor into Pauling's scale of negativities. DAUDEL, P., AND DAUDEL, R. *J. Radium* (*Sér.* 8) **7**, 12–15 (*Jan.*, 1946) *In French.*—greement between Pauling's theory of electro- vity and experimental data is found to be improved roduction of a charge effect, and this aids the retation of the increase of electronegativity which panies an increase of valency. The treatment les: the evaluation of the charge effect; the scale of onegativity of neutral atoms; and calculations of lectronegativities of elements of a given molecule f heats of formation. H. H. HO.

52 : 541.115 = 4 2679

ling's scale of electronegativity and heat of forma- f inorganic compounds. HAÏSSINSKY, M. *J. Phys. m.* (*Sér.* 8) **7**, 7–11 (*Jan.*, 1946) *In French.*—ng's relation between electronegativity and heat of ation is compared with experimental data. Notable tions are observed for fluorides and oxides, which ase systematically with the difference between the onegativities of the components of a molecule. The nce of heats of sublimation and of valency is dis- d. The electronegativities are calculated for the e of the periodic system and interpreted by the aid e periodicity of the heats of formation of certain s of inorganic compounds. H. H. HO.

7 : 539.133 *see Abstr.* 2609

7 : 548.735 2680

e accuracy of bond-length estimations obtained by le Fourier series methods from X-ray data. ROBERT- J. M., AND WHITE, J. G. *Proc. Roy. Soc. A*, **190**, 41 (*Aug.* 12, 1947).—The accuracy has been ed experimentally for a hypothetical structure con- ng 12 atoms in general positions. An *f* curve opriate to average hydrocarbon structures has been loyed, and the results should be applicable to a wide e of organic crystals. Errors due to incompleteness he Fourier series, and to random and systematic rs in the *F* values have been investigated. It is con- ed that in careful determinations with extremely small symmetric crystal specimens and with reliable photo- ic or very careful visual estimates of intensities, ied to the limit of Cu radiation, the max. error in a plex structure should not $> 0{\cdot}03$ Å, and the probable r will be $\sim 0{\cdot}015$ Å for atom separations of $1{\cdot}0$–$1{\cdot}4$ Å. ne series is incomplete, or if systematic errors are ent (such as might be due to absorption in a crystal imen of irregular shape or to instrumental faults), these limits will be exceeded. A.

541.61 = 4 268

A comparison between the two methods of constructing molecular diagrams. COULSON, C. A., DAUDEL, P., AND DAUDEL, R. *Rev. Sci., Paris*, **85**, 29–32 (*Jan.*, 1947) *In French.*—Earlier methods by Pauling and Svartholm, based on bond order, bond character and free valence, which have the disadvantage of not permitting the direct comparison of two different molecules, are now improved by the diagrams of Daudel and Pullman which remove this disability. An alternative method by Coulson based on the theory of molecular orbitals also possesses the same advantage. The two methods are now compared and found to be in excellent accord, while they each introduce a new viewpoint of the problem. H. H. HO.

541.61 : 539.132 = 4 *see Abstr.* 2605

541.64 : 536.7 : 548.5 *see Abstr.* 2689

CHEMICAL PROCESSES 542.9

542.921.9 : 537.525 2682

Interaction of nitrous oxide, nitrogen and phosphorus under silent electric discharge. DESHMUKH, G. S., AND KANE, Y. D. *Proc. Indian Acad. Sci. A*, **25**, 247–55 (*March*, 1947).—The reaction between P films and N_2O, N_2, and O_2 in a silent electric discharge at various potentials (V) and pressures (P) commences after V has attained a min. threshold value, V_m; the discharge current (i) and reaction rate then depend on V–V_m. The reaction mechanism postulated for the P–N_2O reaction is: (*a*) $N_2O \rightarrow N_2 + O$; (*b*) $N_2O \rightarrow NO + N$; (*c*) $NO \rightarrow N + O$. (*a*) and (*b*) are simultaneous reactions and the atomic products are immediately removed by P; (*c*) occurs more slowly. The removal of the N_2 to form a phosphorus nitride is the slowest process. The time-variation of i is synchronous with, but more pronounced than that of P and is more helpful in elucidating reaction stages. W. R. A.

542.921.9 : 539.16/.18 *see Abstr.* 2623–4

542.941.7/.8 : 541.128 2683

On the catalytic dehydrogenation of naphthenes. I. Kinetic study. II. Competition experiments and energies of C–H bonds. HERINGTON, E. F. G., AND RIDEAL, E. K. *Proc. Roy. Soc. A*, **190**, 289–328 (*Aug.* 12, 1947).

CHEMICAL ANALYSIS 543/545

543.812 : 621.317.39 2684

A new electrical method for determining moisture content. BOEKE, J. *Philips Tech. Rev.*, **9** (*No.* 1) 13–15 (1947).—[Abstr. 2224 B (1947)].

545.82 2685

Index to the literature on spectrochemical analysis. *J. Opt. Soc. Amer.*, **37**, 499 (*June*, 1947).—A second volume (1940–5) has been issued by the American Society for Testing Materials. It contains $\sim$ 1 000 entries, with abstracts.

545.822 2686

Spectrochemical analysis of high copper in cast iron and steel. KENNEDY, W. R. *J. Opt. Soc. Amer.*, **37**, 154–8 (*March*, 1947).

545.827 : 537.534.72 *see Abstr.* 2579

CRYSTALLOGRAPHY 548

.0 : 535.327 *see Abstr.* 2479

.0 : 535.66 : 537.531 2687

n the theory of crystal coloration by X-rays. DRU- EV, G. F. *C.R. Acad. Sci., URSS*, **52** (*No.* 3) 215–17 (1946).—A "hole" theory is developed. A potential well is essential for the formation of a centre of light absorption, and the well is formed in the place where a negative ion is ejected by thermal vibration. It is shown that

sufficiently hard X-rays can themselves form holes in the lattice. L. S. G.

548.0 : 535.662.2 : 549.514.51 2688

Thermal discoloration of smoky quartz. Vedeneyeva, N. E., and Chentzova, L. G. *C.R. Acad. Sci. URSS*, **55** (*No.* 5) 437–40 (1947).—The colour (natural or produced by irradiation) appears to be due to extremely small quantities of impurity trapped during crystallization. Magmatic quartz (formed above 575°c) shows all degrees of colour, the presence or absence of the necessary impurity being apparently random. In pegmatic and low-temp. quartz the degree of colour decreases with the temp. of formation, being practically zero for quartz formed below 300°c. The colour disappears on heating, gradually at temp. > 220°c, and very rapidly > 310°c, but is largely regained on slow cooling. Curves are given of the optical density for various wavelengths, temperatures, and times of heating. A. J. C. W.

548.0 : 537.226.8 = 4 *see Abstr.* 2556

548.5 : 541.64 : 536.7 2689

Thermodynamics of crystallization in high polymers. I. Crystallization induced by stretching. Flory, P. J. *J. Chem. Phys.*, **15**, 397–408 (*June*, 1947).—A theory of oriented crystallization in elongated polymers having network structures (e.g. in vulcanized rubber) is developed through the application of statistical mechanical procedures similar to those employed in rubber elasticity theory. Expressions are derived which, within the limitation imposed by the simplifying assumptions, relate the incipient crystallization temperature with the elongation, the degree of crystallinity with the elongation and temperature, and the retractive force at crystallization equilibrium with the elongation at constant temperature. Apparent disagreements with various observations are attributed to severe departure from equilibrium crystallization when the polymer undergoes crystallization during the stretching process. Reasons for the rapid increase in tension which is observed when crystallization occurs during ordinary stretching of rubber are discussed. A.

548.55 = 3 2690

Single crystals of barium-titanium compounds. Blattner, H., Matthias, B., and Merz, W. *Helv. Phys. Acta*, **20** (*No.* 2) 225–8 (1947) *In German.*—Crystals prepared from solution in molten (K, Na)$_2$CO$_3$ were hexagonal and had the composition BaO . TiO$_2$. Those obtained from solution in molten BaCl$_2$ were tetragonal, pseudo-cubic, and contained a greater proportion of TiO$_2$. A. J. C. W.

548.7 2691

Direct determination of stacking disorder in layer structures. Zachariasen, W. H. *Phys. Rev.*, **71**, 715–17 (*May* 15, 1947).—A stack of N identical, parallel and equidistant layers is used as a simple model of a layer structure. Irregularities in the relative displacements δ parallel to the plane of the layers correspond to stacking disorder. The stacking disorder is described by means of a set of functions $W_M(\delta)$ which measure the probability of finding a relative displacement δ for layers M spacings apart. It is shown that X-ray diffraction data permit a direct determination of the Fourier coefficients of the functions W_M. Thus these functions can be synthesized and the nature of the stacking disorder directly deduced. A.

548.7 : 535.347 : 535.51–15 : 535.343.2 *see Abstr.* 2499

548.7 : 535.375.5 : 535.343.2–15 : 539.11 = 4 *see Abstr.* 2603

548.7 : 539.32 : 669.355 2

Contributions to the theory of beta-phase all Zener, C. *Phys. Rev.*, **71**, 846–51 (*June* 15, 1947).— alloys of the type of β-brass decrease their concentrat range in the disordered state as the temperature is lower The original theory of Jones [Abstr. 2719 (1937)] shown to be inadequate, and the observed variation w temperature of the phase boundaries is shown to foll directly from the assumption that the β-phase ha slightly lower characteristic temperature than the nei bouring phases. β-brass has an extremely high ela anisotropy. This property is in part a result of anomalously low value of $(C_{11} - C_{12})/2$, which is sho to be interpretable in terms of lattice type and inter-io interactions. This interpretation also explains positive value of the temperature coefficient of E_{100}.

548.73 2

Divergent beam X-ray photography of crystals. Lo dale, K. *Philos. Trans. A* (*No.* 817) 219–50 (*March* 1947).—Divergent beam photographs of single cryst are used to study the diminution of the transmit radiation which takes place at the Bragg reflexi Useful information about the texture of the crystal obtained and many crystals of organic compounds found to be unexpectedly perfect. Sudden cooling liquid-air temperatures will increase the mosaic charac of the structure and make them more suitable structural analysis by ordinary methods. Certain ty of diamonds and natural ice possess a high degree perfection, which is not removed by liquid air treatme Orientation may also be determined by the use of div gent beams. Lattice constants and wavelengths may determined in some cases from the photographs. It found that the C–C distance in individual diamor varies from 1 541·53 (±0·02) to 1 541·27x. T Zn $K\alpha_1$ wavelength, relative to Cu $K\alpha_1$ as 1 537·40x found to be 1 432·21 (±0·04)x. L. S.

548.73 : 532.7 = 3 2

The X-ray diffraction pattern of water. Simons, *Comment. Phys.-Mat., Helsingf.*, **10** (*No.* 9) 26 *pp.* (19 *In German.*—The X-ray scattering from a freely-flow stream of water 1 mm in diameter was recorded pho graphically, Cu $K\alpha$ radiation reflected from a bent Na crystal being used. Corrections for absorption a polarization were applied to the observed intensity scattering. The radial distribution of O atoms v evaluated by Fourier transformation and compared w that in ice. A. J. C.

548.73 : 532.7 = 3 26

The X-ray diffraction patterns of benzol, toluol a mixed xylols. Simons, L. *Comment. Phys.-Mc Helsingf.*, **10** (*No.* 10) 11 *pp.* (1940) *In German.*—A stu similar to that made of water [Abstr. 2694 (1947)]. A. J. C.

548.733 26

High-temperature X-ray diffraction apparatus. V Valkenburg, A., Jr., and McMurdie, H. F. *J. R Nat. Bur. Stand., Wash.*, **38**, 415–18 (*April*, 1947).— furnace for obtaining patterns of samples at elevat temperatures with an X-ray spectrometer using a Geig counter is described. Any number of patterns can obtained without intermediate cooling of the samp the pattern is produced in 40 minutes in a form ready f study; patterns can be obtained at temperatures up 1 500°c. The diffraction data for the α form of 2CaO.SiO are given.

548.733 : 539.262 26

X-ray diffraction camera for microtechniques. Chesle F. G. *Rev. Sci. Instrum.*, **18**, 422–4 (*June*, 1947).—

otion of a camera for recording diffraction phenofrom selected microscopic regions of solid materials. ceable collimator systems give beam diameters from 25 microns. The camera body may be removed ts support and replaced without readjustment. A.

3 : 621.385 = 4 2698

use of X-ray crystallography in the vacuum-tube ry. NGUYEN, T.-C. *Ann. Radioélectricité*, **1**, 0 (*Oct.*, 1946) *In French.*—[Abstr. 2280 B (1947)].

3 : 621.386.1 2699

construction of an X-ray diffraction unit including a systems and accessory equipment. BUCHANAN, AND COLE, W. F. *Aust. J. Instrum. Tech.*, **3**, 30–46 1947).—[Abstr. 2295 B (1947)].

35 2700

fuse bands on Laue photographs of silver chloride ls. BURGERS, W. G., AND TAN KOEN HIOK. *, Lond.*, **159**, 845–6 (*June* 21, 1947).—The diffuse previously reported [Abstr. 3004 (1946)] have been l to disappear at liquid air temps., and are thus ely to be due to lattice deviations.

35 : 541.57 *see Abstr.* 2680

35.4 = 4 2701

a precise spectroradiographic method for determining ly the absolute value of a lattice parameter. HOMÈS, . *Bull. Acad. Belge, Cl. Sci.* (*Sér.* 5) **32** (*Nos.* 1–3) 3 (1946) *In French.*—A reiterative method applicable bic crystals. A. J. C. W.

35.44 2702

ystal pattern synthesis by an approximate summation ourier series. LUKESH, J. S. *J. Appl. Phys.*, **18**, 3 (*June*, 1947).—A faithful representation of the ions of the peaks of electron density maps can be ined rapidly by determining for each point in the ected unit cell the algebraic sum of the amplitudes of e reflections which are contributing either a max. or n. at each point. Since maxima and minima do in general, fall at the specific points of the grid, an oximation must be introduced. Using the semi- form of Fourier series, the approximate summa- can be accomplished with the use of 150 strips. method was tested by determining the peak tions in the structure of diopside projected on 001. ntial applications of the approximate summation ade rapid checking of the validity of assumed crystal ctures. A.

736.33 2703

he structure of the fluorides and oxifluoride of bivalent . BYSTRÖM, A. *Ark. Kemi Min. Geol.*, **24 A** (*Paper* 18 *pp.* (1947).—Orthorhombic PbF_2 has the space up Pmnb, $a = 3{\cdot}889 \pm 2$, $b = 6{\cdot}428 \pm 3$, $c = 33 \pm 4$ kX. Cubic PbF_2 has the fluorspar structure, $a = 5{\cdot}923 \pm 3$ kX. Pb_2OF_2 is tetragonal, $a = 8{\cdot}135 \pm 4$, $c = 5{\cdot}706 \pm 3$ kX. Powder-photograph data are given. A. J. C. W.

548.737 = 4 2704

X-ray study of β chloroesters of some long-chain fatty acids. BRENET, J. *J. Phys. Radium* (*Sér.* 8) **7**, 139–44 (*May*, 1946) *In French.*—The β-chloro esters of lauric, myristic, palmitic and stearic acids have been examined by means of the rotating crystal method. The long spacings are respectively 38·6 Å, 43·3 Å, 47·9 Å and 52·6 Å. The axis of the molecule is in each case inclined at 72° to (001). An extension of the method used by Shearer for calculating the intensities of the different orders of reflection for the long spacings of simpler long chain compounds gives good agreement between observed and calculated intensities for the present compounds. J. I.

548.74 2705

Single crystal electron diffraction by micro-crystalline materials. DAVIDSON, N., AND HILLIER, J. *J. Appl. Phys.*, **18**, 499–511 (*June*, 1947).—It is shown that the double lens probe-type electron diffraction camera described earlier [Abstr. 1171 B (1946)] is capable of producing useful electron diffraction patterns of single microscopic crystals in the size range 200–2 000 Å. A number of examples are shown. It is possible to obtain accurate values for some of the lattice spacings, and to deduce accurately the orientation of the crystals relative to the electron beam. The results are shown to agree reasonably well with the predictions of MacGillavry's dynamical theory [Abstr. 1926 (1940)]. It is concluded that a 2-dimensional grating pattern is to be expected from a crystal oriented with an important lattice vector approximately parallel to the electron beam. A.

548.74 : 537.533.73 = 3 2706

Precision comparison of lattice constants by the Fraunhofer arrangement. MÖLLENSTEDT, G. *Z. Naturforsch.*, **1**, 564–6 (*Oct.*, 1946) *In German.*—Lattice constants are determined by the use of a reference substance, such as a thin sheet of mica, placed so that it is struck by half the electron beam, the other half of which strikes the material being investigated. The diffracted beams are focused on the photographic plate, the magnetic lens being placed between the electron source and the specimen. J. T.

MINERALOGY 549

549.1 : 535.525 = 5 *see Abstr.* 2528

549.514.51 : 535.323 : 535.561 *see Abstr.* 2529

549.514.51 : 535.561 : 535.43 *see Abstr.* 2523

549.514.51 : 535.662.2 : 548.0 *see Abstr.* 2688

GEOPHYSICS 55

0.31 : 539.32 : 539.501 = 5 2707

On the internal friction in the earth's crust. CALOI, P. . *Sci.*, **14**, 4–7 (*Jan.*, 1943) *In Italian.*—Viscosity, ernal friction, strength and relaxation time are dis- sed and fundamental relations quoted. From a study superficial tangential waves at the Cansiglio earthquake 36) the coefficient of internal friction of the earth's ust is 10^{10} poises, the ratio of this coefficient to the od. of rigidity is $\sim 2 \times 10^{-2}$. J. A. W.

0.341 = 5 2708

On the energy associated with seismic *SKS* and *SKKS* ves. VALLE, P. E. *Ric. Sci.*, **14**, 8–14 (*Jan.*, 1943) *Italian.*—Previous investigations [Abstr. 2815 (1939)] indicating a discontinuity in the nucleus of the earth are discussed, with regard to the apparent velocity increase of *PKP* waves. The energy density in *SKS* waves is considered theoretically by an approx. method; it is shown that the waves cannot in general be observed at epicentral distances >135° or <62°, and this is attributed to refraction at the nuclear surface. J. A. W.

550.341 : 534.2 = 5 2709

On the dispersion of direct seismic waves. VALLE, P. E. *Ric. Sci. Ricostruz.*, **15**, 424–5 (*Oct.–Nov.*, 1945) *In Italian.*—Considering an elementary spherical wave originating at a depth h in a granite layer, phase and group velocities are graphed and a table of absorption

values show that h.f. components are absorbed faster than l.f. components; thus increased velocity values may be found on approaching the epicentre. J. A. W.

550.341 : 534.21 = 5 2710

Absorption and attenuation of some types of seismic waves. VALLE, P. E. *Ric. Sci.*, **14**, 177–82 (*April*, 1943) *In Italian.*—The propagation of waves generated by an initial disturbance $f(\lambda)$ at $x = 0$, in a quasi-elastic medium in which absorption depends on frequency, is treated mathematically, and the cases of $f(\lambda) = 0$ for $\lambda < -a$ and $\lambda > +a$, $f(\lambda) =$ a Gaussian or an asymmetric function, and $f(\lambda) =$ an unidirectional impulse, are considered. J. A. W.

550.37 : 551.594 *see Abstr.* 2732

550.372 = 5 2711

On new families of universal electric resistivity curves. BELLUIGI, A. *Ric. Sci.*, **13**, 199–203 (*April–May*, 1942) *In Italian.*—A set of theoretical reference curves of apparent resistivity of geological structures is developed and the application to monocline, anticline and syncline configuration is explained. J. A. W.

550.385 = 4 2712

Prediction of magnetic storms. DAUVILLIER, A. *C.R. Acad. Sci., Paris*, **222**, 1380–1 (*June* 12, 1946) *In French.*—Apparatus for predicting the storms is described briefly. It is installed at the Observatory of Pic du Midi, and has given satisfactory service for more than a year. L. S. G.

550.423 : 537.591 : 539.167.3 *see Abstr.* 2642

550.834(204.1) 2713

Marine seismic prospecting. HILL, M. N., AND WILLMORE, P. L. *Nature, Lond.*, **159**, 707–8 (*May* 24, 1947).—To avoid the difficulties of placing explosives and recording instruments on the sea bed, the practicability of suspending them in the water, and relying on the transmission of the seismic waves from the bottom into the water, was confirmed by direct comparison of the records of a geophone on the bottom and a hydrophone in the water. A sample record is reproduced.

550.839 : 539.185.9 2714

Neutron well logging by gamma-rays. GORSHKOV, G. V., AND LIATKOVSKAYA, N. M. *C.R. Acad. Sci. URSS*, **55** (*No.* 7) 601–4 (1947).—The method is based on the measurement of γ-rays returned by rock-formations when they are irradiated by fast neutrons. Experimental conditions have been investigated and results agree satisfactorily with theory. A. J. M.

551.465 : 532.59 = 3 2715

Stationary cellular waves in the sea. NEUMANN, G. *Naturwiss.*, 33, 282–3 (*Nov.* 15, 1946) *In German.*—Extremely short period waves not connected with discontinuity surfaces can occur in air or water with vertical stability and are related more to cellular gravitational waves. The form of the cellular oscillation depends on vertical velocity distribution. Observations at sea at two Baltic stations of temperature and vertical density gradients show agreement with theory. Causes of the initial disturbance are discussed. R. S. R.

METEOROLOGY 551.5

551.501.45 : 519.24 = 5 2716

On the relations between the statistical characteristics used in meteorology. LOVERA, G. *Ric. Sci.*, **14**, 128–33 (*Feb.–March*, 1943) *In Italian.*—Mean quadratic deviation, asymmetry, mean deviation, daily, monthly and annual amplitude, are defined and the importance of these values in characterizing the climate of various localities is explained and illustrated by examples. J. A. W.

551.51 2

The upper atmosphere of the earth. HULBURT, E. *J. Opt. Soc. Amer.*, **37**, 405–15 (*June*, 1947).—Descri briefly present knowledge of the atmosphere up to ionosphere and mentions the contributions which rocket experiments have made.

551.510.3 : 535.33 *see Abstr.* 2484

551.510.3 : 535.43 : 535.372 = 4 *see Abstr.* 2512

551.510.535 2

The true height of an ionospheric layer. PIERCE, J. *Phys. Rev.*, **71**, 698–706 (*May* 15, 1947).—A sim method has been developed for the analysis of io spheric sweep-frequency records in terms of the sc height and true height of maximum of the layer of Ch man form which most closely fits the observed da It is shown that the height of maximum determined the method of Appleton, Booker and Seaton is the hei of a parabolic layer which is not coincident with parabola that most closely fits the Chapman distributi The present method includes a correction for retardati in one or more layers of similar form which lie below reflecting layer.

551.510.535 : 523.78 : 537.568 2

Concerning the problem of ionosphere investigati during solar eclipse in Brazil on May 20, 1947. ALPERT, AND AINBERG, A. *J. Phys., USSR*, **11** (*No.* 1) 9 (1947).—The computed variation of ionization of *E*-layer to be expected during a total eclipse in the regi of S. Salvador (Bahia) is given in graphical form.

551.510.535 : 621.396.11 : 537.566.3 *see Abstr.* 2602

551.510.535 : 621.396.812 : 621.396.11 = 4 2

The effects of solar chromospheric eruptions on ionosphere and on the propagation of radio waves. Th effects in the various regions of the radio-wave spectru BUREAU, R. *Onde Élect.*, **27**, 45–56 (*Feb.*, 1947) *French.*—[Abstr. 2322 B (1947)].

551.510.535.08 : 621.396.11 2

Ionosphere equipment for field use. MUSSELMAN, G. *Electronics*, **20**, 112–16 (*May*, 1947).—Designed prima for the observation of shift of the *E*-layer critical f quency during a solar eclipse. The transmitter wa 10 kW oscillator feeding a resistance-terminated ho zontal aerial and swept continuously from 1·5 to 4 M with a pulse length of 100 μsec and a pulse recurre rate of 10/sec. The recording apparatus, housed $\frac{1}{2}$ m distant, consisted of a folded doublet $\frac{1}{2}\lambda$ aerial feed the receiver and an oscilloscope with continuou recording camera. A discriminator and servomechani maintained the receiver in tune within 2 kc/s and limiti was provided to suppress the effects of varying sig strength. H. G. M

551.510.535.08 : 621.396.9 = 4 2

Powerful ionospheric radio-sounding apparatus. LEJ P., AND CHEZLEMAS, R. *C.R. Acad. Sci., Paris*, 2 1363–6 (*June* 12, 1946) *In French.*—Transmitting, rece ing and recording apparatus, used for obtaining co tinuous ionospheric records in France are describe Examples of the photographs obtained are given. L. S.

551.521.1 2

Registration of insolation. AURÉN, T. E. *Ark. M Astr. Fys.*, **34 A** (*Paper* 12) 20 *pp.* (1947).—Comparat experiments were made with 3 types of pyranometers determine insolation. Examples are given of reco obtained. The author's photographic method is co pared with the Micromax recorder based on the potent meter method. The commonly used screening meth for conversion of reduction curves, and errors arisi are described. A new method based on determination

itivity of instrument combination in relation to the l scale for global radiation was tested over the period –42. Effects of mist in lower atmosphere discussed. R. S. R.

524.7 + 551.547 2724

ressure and temperature of the atmosphere to 120 km. , N., HAVENS, R., AND LAGOW, H. *Phys. Rev.*, **71**, 16 (*June* 15, 1947).—Measurements made with a rocket are described. Altitude-pressure and altitude-. curves are given. W. E. D.

547 + 551.524.7 *see Abstr.* 2724

574 = 4 2725

n molecular centres of condensation and atmospheric omena. DEBIERNE, A. *C.R. Acad. Sci., Paris*, **222**, –4 (*June* 3, 1946) *In French.*—The centres consist of ecules of HNO_3, which have absorbed several ecules of H_2O, and a cluster of centres can be trans-ed into tiny water droplets which grow slowly in rsaturated air. The part played by such centres ich may, for example, be created in great numbers by tomic bomb) in atmospheric phenomena is discussed. L. S. G.

593 : 525.75 2726

leasurements of the intensity of the night sky light at cutta. GHOSH, S. N. *Indian J. Phys.*, **20**, 205–13 c., 1946).—On undisturbed nights, the intensity reased with advance of night, attained a min. near l midnight and then again increased. Of the total nights observed, 30% were disturbed, i.e. the intensity ations were erratic. On disturbed nights which were ompanied by magnetic disturbance, the trend of iation was approximately the same as the variation maximum ionization of Region *F*. This supports the othesis of Mitra [Abstr. 2685 (1943)] in which the inescent layer is identified with Region *F*. A.

.593.12 2727

hotographic measurements of atmospheric boil. RIGGS, A., MUELLER, C. G., GRAHAM, C. H., AND MOTE, F. A. *Opt. Soc. Amer.*, **37**, 415–20 (*June*, 1947).—It has been nd with the aid of instantaneous photographs of out-or targets that the average deviation, caused by boil, ays from a point on a target to the camera is in excess 3″ over level ground in bright sunshine; the max. iation may reach >9″ under these conditions. With nts whose separation has an angular subtense at the era > 5′, the effects of boil upon the two are essen-ly independent. A.

.593.5 : 535.343.4 = 3 2728

n absorption layer in the upper atmosphere? GÖTZ, W. P. *Experientia*, 3 (*No.* 6) 238 (1947) *In German.*—e varying intensity of the 2 863 Å line, and the abrupt mination at 2 400 Å, of the solar spectrum indicate an orption, possibly due to NO_2^+ or NO^+. A.

551.593.5 : 535.43 = 82 2729

Optical study of the atmosphere by searchlight. KHVOSTIKOV, I. A. *Bull. Acad. Sci. URSS Sér. Phys.*, **10** (*No.* 4) 403–14 (1946) *In Russian.*—The author surveys previous work on optical scattering by the atmosphere based on the use of powerful searchlight. New results are described on the polarization, intensity and spectral distribution of light scattered at heights up to 55 km. D. S.

551.593.7 : 523.78 = 5 2730

The state of polarization of the sky in Rome during the partial solar eclipse 9 July 1945. CIALDEA, R. *Ric. Sci. Ricostruz.*, **15**, 385–7 (*Oct.–Nov.*, 1945) *In Italian.*—Diagrams show the results of observations (every minute) with photo-electric apparatus (polaroid analyser), which was tested throughout the spectrum. Natural light fades more quickly than polarized light, the degree of polarization remaining const. J. A. W.

551.594 = 5 2731

Electric activity index. MEDI, E. *Ric. Sci. Ricostruz.*, **15**, 400–4 (*Oct.–Nov.*, 1945) *In Italian.*—The sum of all observed differences between the squares of field intensity over a given period is taken as index of atmospheric electric activity, representing variations in electric energy. A method of simplified calculation is given, illustrated by a numerical example. J. A. W.

551.594 : 550.37 2732

Atmospheric electricity and lightning. FRENKEL, J. *J. Franklin Inst.*, **243**, 287–307 (*April*, 1947).—Continuing the presentation of the author's theory on the electrification of thunderclouds [Abstr. 364, 1078 (1947)] the processes responsible for the electrification and recombination of charged water particles under the action of gravity are discussed. The field strength inside the cloud is determined for which equilibrium between these two phenomena is reached. The lower negative charge in a bi-polar cloud is shown to compensate the upper positive charge and, in addition, the positive space charge in the surrounding atmosphere. The field strength between cloud and ground resulting from the foregoing charge distribution is determined. In contradistinction to present conceptions, the electric charges in thunderclouds and the resulting convection currents are shown to be solely responsible for the maintenance of the earth's electric field. The initiation of corona discharges at the earth's surface and of lightning discharges in clouds is briefly sketched. R. H. G.

551.594.5 : 535.33 = 3 2733

On the aurora spectrum of 17 April, 1947. GÖTZ, F. W. P. *Experientia*, 3 (*No.* 5) 185–7 (1947) *In German.*—The forbidden line 5 199 Å was observed, and confirmation obtained of the long duration of the excited state, calculated by theory to be 5 hours. A.

BIOLOGY 57/59

.088.5 : 621.386.1 : 537.531 *see Abstr.* 2574

EDICAL SCIENCE . HUMAN PHYSIOLOGY 61

.84 2734

tiles and Crawford effect in polarized light. O'BRIEN, J. *Opt. Soc. Amer.*, **37**, 275–8 (*April*, 1947).—The ct of polarization on the light transmitted by total ernal reflection down a retinal cone has been studied means of a model and shown to be very small. Thus absence of the effect is no argument against this planation of the Stiles–Crawford effect. J. W. T. W.

612.843.37 2735

The change in refractive power of the human eye in dim and bright light. WALD, G., AND GRIFFIN, D. R. *J. Opt. Soc. Amer.*, **37**, 321–36 (*May*, 1947).—It has been found that observers set telescopes more negatively in dim light to compensate for an apparent myopia. This effect has been measured on 21 observers, and an average value of 0·59 dioptres found. It is largely explained (0·4 dioptre) by the chromatic aberration of the eye (measured on 14 observers) combined with the Purkinje shift of max. visual sensitivity in dim light. Larger changes are due to involuntary changes in the accommodation. A.

612.843.6 2736

The relation of the configuration of a brightness contrast border to its visibility. FRY, G. A. *J. Opt. Soc. Amer.*, **37**, 166–75 (*March*, 1947).—The minimum perceptible brightness contrast has been measured for fields with various forms and dimensions of separating lines. It was found that the width of a rectangle had little effect until it was very small, but elongation improved perceptibility. Investigations were also made on polygons and on saw-tooth patterns. J. W. T. W.

612.843.6 2737

The visibility of lines and squares at high brightnesses. HECHT, S., ROSS, S., AND MUELLER, C. G. *J. Opt. Soc. Amer.*, **37**, 500–7 (*June*, 1947).—Field experiments show that a wire may be seen against a sky of high brightness when its diameter subtends only $\frac{1}{4}''$ of visual angle. For this the wire must be $\not< 1°$ long. Shorter wires must be thicker. Silhouetted squares may be seen at angles of only 18″. Considering length and width, squares are more efficient visual targets than fine lines by about a factor of 3. A.

612.845 = 4 2738

The chromatic and spherical aberrations of the eye: their role in night-vision. IVANOFF, A. *Rev. Opt. (Théor. Instrum.)* **26**, 145–88 (*May–June*, 1947) *In French.*—Aberrations of a dozen eyes were measured. Results obtained for the chromatic aberration suggest that the dispersions of the different media of the eye are close to that of slightly salt water, except the crystalline lens, which is more dispersive for short wavelengths. The results for spherical aberration show the strong influence of accommodation. A new theory of "night-myopia" and "night-presbyobia" is based upon these results. It is concluded that these terms are unsuitable, since the conditions only represent the possibility of states of accommodation which tend to annul the spherical aberration of the eye. H. H. HOP.

612.845.5 : 535.65 2739

Use of a monochromatic colorimeter for the study of color blindness. VAN DEN AKKER, J. A., TODD, J. F. NOLAN, P., AND WINK, W. A. *J. Opt. Soc. Amer.*, 37 363–87 (*May*, 1947).

612.85 274

On hearing in water *vs.* hearing in air. SIVIAN, L. J. *J. Acoust. Soc. Amer.*, **19**, 461–3 (*May*, 1947).—The pape deals with the ability of a submerged listener to hea sounds generated in the air above him. In a theoretica discussion it is shown that at 1 kc/s a loss of ~ 45–55 db might be expected. A few measurements mad at 1 and 3 kc/s yielded values which are not at varianc with the theoretical analysis.

612.858 274

Observation of cochlear structures during the process o hearing. KOBRAK, H. G. *J. Acoust. Soc. Amer.*, 19 328–31 (*March*, 1947).

612.858 274

The variation of phase along the basilar membrane wit sinusoidal vibrations. v. BÉKÉSY, G. *J. Acoust. Soc Amer.*, **19**, 452–60 (*May*, 1947).—An optical means o measuring phase relations in the cochlea is describe With the stapes set into sinusoidal vibration, the phas relations, measured along the length of the cochlea partition, show that a travelling wave has been set up The form of resonance which appears does not correspon at all with that to be found in a simple vibrating systen Measurements are presented for a frequency of 200 c of the amplitude and phase of vibration at various place along the cochlear partition. From these is derived curve showing the longitudinal bending of the partitio with the travelling wave at two different points in time The elastic properties of the various tissues within th cochlear partition were measured; only the elasticity o the basilar membrane changes through the length of th cochlear canal. The non-linearity in the vibration of th partition indicates that the observed lowering of pitch o tone when the loudness is increased cannot be produce by mechanical means.

615.849 : 535.43 : 537.531 *see Abstr.* 2573

PHOTOGRAPHY 77

77.012 : 541.127 = 5 2743

The development of photographic emulsions as a phenomenon of chemical equilibrium. TORALDO DI FRANCIA, G. *Ric. Sci. Ricostruz.*, **15**, 156–8 (*Aug.*, 1945) *In Italian.*—Considering the characteristic: optical density *v.* log exposure, it is suggested that the Ag reduced directly by the photons is not only a true catalytic agent but is in an energy state such as to affect the equilibrium constant. If C = conc. of developer, c = conc. of reduced Ag, and the equilibrium const. $\propto$ exposure E, the law of mass action for a bimolecular process is $c^2/(C-c) = kE$. This agrees with the experimental characteristic. J. A. W.

771.534 : 537.531 2744

Note on the change of spectral sensitivity of photographic emulsions at the silver *K*-edge. SANDSTRÖM, A. E. *Ark. Mat. Astr. Fys.*, **34 B** (*Paper* 10) 7 *pp.* (1947).—The density on the long-wavelength side of the absorption edge is about 56% of that on the short-wavelength side for densities $< 0{\cdot}5$, increasing to about 75% for high densities. The ratio depends somewhat on the developer and type of film. A. J. C. W.

771.534.554 = 5 2745

Research on resolving power, grain and contrast and their relations in photographic emulsions. FRACASTORO, M. G. *Ric. Sci.*, **13**, 665–76 (*Nov.*, 1942) *In Italian.*—With a camera of objective $f = 296$ mm, and usir several different diaphragms, a series of black and whi striped cards (25–100 lines per mm) were photographe using various types of emulsion, and the negativ microscopically examined. A second series was ma using an objective of $f = 25$ mm. Results are tabulate and discussed, and the effects of contrast and of gra structure of the emulsions and the diffusion of lig inside the sensitive layer are shown. J. A. V

771.534.554 : 539.16.08 = 5 27

On the fluctuations of grain density in photograph plates. LOVERA, G. *Ric. Sci.*, **13**, 677–82 (*Nov.*, 1942) *Italian.*—Formulae are derived for the mean quadrat deviation of grain density values in the statistic fluctu tions observed in corpuscular radiation records, in ter of the mean number of grains per unit length of trace a the diameter of the "sphere of action" of the single gra which is about $1{\cdot}6\ \mu$ for the plates examined, and th $1{\cdot}6 \times$ the physical grain dia. Experimental results a some applications are discussed. J. A.

778.3 : 621.385.833 27

Photographic registration of electron images by mea of X-rays. VON FRIESEN, S. *Ark. Mat. Astr. Fys.*, 33 (*No.* 4) *Paper* 19, 7 *pp.* (1947).—[Abstr. 2294 B (1947

778.34 : 539.164.93 *see Abstr.* 2638

778.34 : 539.185.7 = 3 *see Abstr.* 2657